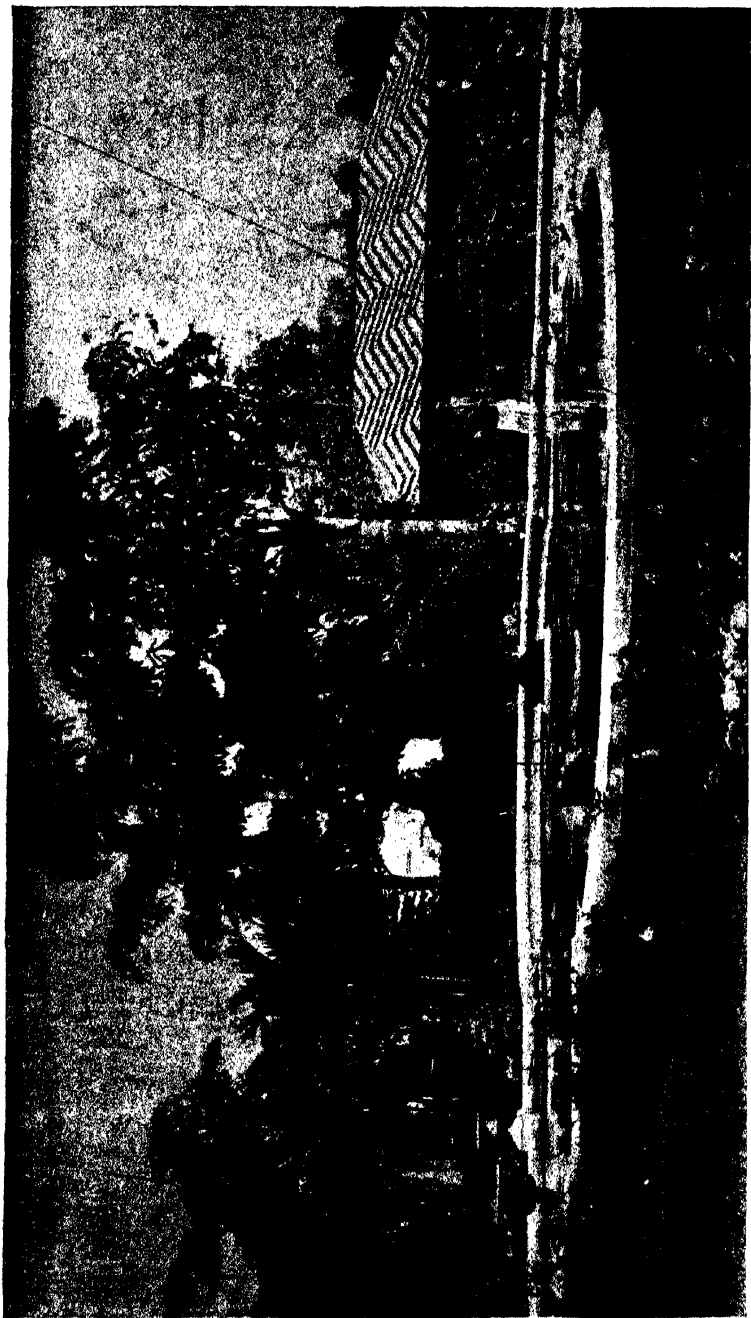


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GARDENING IN THE TROPICS



GARDEN NEAR MADRAS.

GARDENING IN THE TROPICS

BEING A SIXTH EDITION OF

“GARDENING IN INDIA”

ADAPTED FOR ALL TROPICAL
OR SEMI-TROPICAL REGIONS

BY

G. MARSHALL WOODROW

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With Eighty-four Illustrations

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P R E F A C E

INTENSE cultivation of the soil, or gardening, has special attractions in hot climates from the rapidity of growth and early fecundity of garden crops. To plant banana offsets and reap the glorious bunch of fruit within a year; to sow gourds or vegetables, and within eight weeks have the produce on the table, is an experience that familiarity cannot rob of its charm; and in almost every sense, when duly tended, the tropical garden abundantly repays the labour, whether pleasure or profit be the object sought.

Careful study of the following pages will be found advantageous in cultivation not only over a limited area, but, if the climate tables be attentively examined and arrangements to modify temperature and rainfall be adopted, the notes will be found applicable throughout the extensive region in which the south-west and north-east monsoons prevail—that is, from Siam, through Burma, Ceylon, India, in Central Africa and Abyssinia, Central America and the West Indian Islands, and also in the warm parts of South America. Considerable variations in practice, due to latitude, altitude, and shelter from prevailing winds, may be necessary at places only a few miles apart, but such are made clear by the meteorological tables, and when a plant is referred to as thriving at a particular station, the question of the treatment necessary to induce it to thrive at another station becomes of easy solution.

While the book is designed for use in the tropics, it may also be used by cultivators of tropical plants in mild climates, and suggests many contrivances that may be of use in other countries.

Gardening as a means of PROFIT, as well as of PLEASURE, especially to the cultured races within the influence of the monsoons, is kept more prominent in this than in previous editions, by giving more full detail regarding the cultivation of commercial subjects, and, in view of the fact that an examination of old records by competent botanists has proved that names of plants have often been applied without such a thorough search, the publication of a new edition requires an alteration of names.

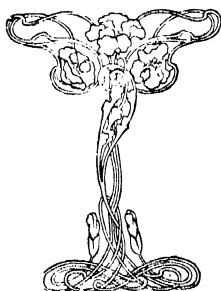
Genuine progress in the cultivation of plants can scarcely exist where the educated races stand aloof and leave cultivation to the most ignorant section of the people. Fortunately, this condition is being gradually ameliorated, and even Brahmins may be indicated who have lived in honour and died rich from the pursuit of horticulture. The cross-breeding of varieties with a view to selection for special soils and climates is a feature to which more attention is distinctly necessary. The idea of improvement by acclimatisation or the importation of sorts of plants that yield abundantly in other climates with a view to their use directly in cultivation, has long been proved fallacious, but the importation of select varieties of fruits, flowers, or field crops of species that thrive in the country concerned, with a view to cross-breeding and the selection of improved sorts adapted for local conditions of soil and climate, is the path by which genuine progress has been attained in advanced

countries, and the only one which indicates success in the region of the monsoon.

The name of the process—"cross-breeding"—unfortunately suggests to Hindus an unhallowed practice condemned by the sacred writings of all creeds, but that there is nothing of that nature in the process referred to, goes without saying. The work is frequently accomplished by NATURE: it is the source of our delicious sorts of banana and mango, of the finest cotton and most valued sorts of grain, and surely what the CREATOR has so abundantly blessed may well become the creature.

"Gardening, man's primeval work,
Is a most blessed toil;
It cheers a man,
Makes him kind-hearted, social, genial,
Forms a serene parenthesis from care,
And his whole nature raises and improves."

G. MARSHALL WOODROW.



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GARDENING IN THE TROPICS.

SOIL.

SOIL is the result of the crushing and breaking up of rocks with the addition of organic remains, whether the agency employed by nature be the irresistible force of the glacier moving slowly over its rocky bed; of the torrent dashing one stone against another; of the expansion of water in freezing, or the less evident but none the less certain action of oxygen, and the acids produced by decaying organisms, or the effects of bacteria or living plants dissolving limestone and silicates to be deposited on the surface with the other remains of plant and animal life.

In ultimate composition soil differs little throughout the world; on uncultivated land in temperate climates, and on mountain-tops and shallow water in the tropics, vegetable matter is formed more rapidly than it decays, hence peat soil accumulates; but generally a difference in the size of the particles of the soil and of the depth of the layer of those minute fragments of rock and the local preponderance of sand, lime, iron oxide, vegetable matter, or clay, are the most prominent features in varieties of soil. Although, in a chemical sense, clay is a silicate of alumina, as far as the cultivation of the soil is concerned it must be considered as the very minute particles of the soil, and, as geologists say, "mud (clay) and sand are pretty much the same everywhere."

When the fine particles of the soil predominate over large areas, such as the prairies of America or the black

soil plains of India and of Russia, the natural vegetation consists largely of grasses and surface-rooting herbaceous plants of little variety, and trees are scanty, but on the mountain side or on soil with abundant stones, trees thrive with special luxuriance. For the garden, where a variety of plants are cultivated, a medium between the tenacious air-resisting soil of the prairie and the stony soil of the mountain side, is desirable; such a soil is termed *Loam*, and may be composed as follows:—

APPROXIMATE COMPOSITION OF LOAM: Small stones, 10%; fine sand, 50 %; clay and oxide of iron, 15%; limestone, 5%; organic matter and water, 15%; potash, soda, magnesia, chlorine, with carbonic, sulphuric, phosphoric, and nitric acids, each in proportion near to 0·5%; and traces of a few substances which, as far as is known, are unimportant. Loam retains water a short time; it absorbs moisture from a damp atmosphere; it permits the passage of water and air and the action of bacteria; it is easy to till; and consequently, when in a favourable climate, it is fertile.

Loam, being the intermediate and most generally useful soil, the other members of the series are *Clay*, in which the very minute particles amount to 50% of the whole, and, in consequence, the soil retains water, is plastic and adhesive while wet, and hard and impenetrable by roots while dry. *Sand*, on the other hand, has particles large enough to be seen by the naked eye, or appealing to the touch of a sensitive hand, and less than 10% of very minute particles. Soil of this nature is easily saturated, but retains little water, and while dry may be transported by the wind. The intermediate conditions are clay-loam, with excess of clay; sandy-loam, with excess of sand.

The colour of the upper layers of a soil is not of much consequence; the *Black-soil* of India and of Russia is greatly loved by the peasantry who work it, because it is the most fertile soil they are acquainted with and thoroughly suited to local climatic conditions,

but it is not more fertile than soils of other shades of colour if present in equal quantity and similar size of particles. In soils generally, a dark colour indicates abundant humus or decaying vegetable matter, and, consequently, assimilable nitrogen and fertility, except in *peat*, where it is present in abundance, and excludes other essential constituents of a fertile soil. The colour of the *black* soil of India does not indicate a remarkable proportion of vegetable matter, but rather a special physical condition acting on the rays of light. When dried in the sun and ground under the wheels of passing vehicles, the Indian black soil assumes the grey colour of the trap rock from which it is derived.

SUB-SOIL.—The layers of soil more than nine inches from the surface, which are not usually disturbed by the plough, are termed *sub-soil*, and sometimes exhibit bluish or yellow colour, from the presence of iron oxide which has not been freely exposed to the air (ferrous oxide). A soil in which this sign appears will require much extra tillage and exposure to moist air to render it fertile as a garden soil, and improvement will be in evidence when the colour of the soil has changed to that of iron rust.

When a soil cracks deeply during dry weather, it usually indicates that the particles are very minute, and as the power of holding moisture is proportionate to the minuteness of the particles, such a soil is specially valuable where a rainy season alternates with several months of drought, relieved during a part of the time by heavy dew. The black soil of the Dekkan is especially of the nature indicated, and bears good crops during the cold season, with a very scanty rainfall. But a garden soil of this kind requires intelligent management. It may not be irrigated during the dry season of several years consecutively without serious injury, which may require a long time to repair. Under irrigation and dry culture suit such a soil, but the market gardener, who must irrigate his land

regularly, prefers the sandy loam found at higher levels; or, in the absence of this, he devotes a part of his land yearly to the ordinary agricultural crops of the district, without irrigation. In Marati phrase, the land must become "hot" e'er it becomes fertile, notwithstanding manure, and this "heating" is impossible if dense, clayey soil be constantly irrigated.

A SOIL FIT FOR A GARDEN may be recognised by naturally bearing a variety of plants, such as grasses, herbaceous plants, and trees well intermixed. If it be occupied by one class of plant only, a special condition—antagonistic to garden culture—may be suspected; it may be the presence of too much salt, or the absence of lime, or a tenacious nature that prevents the passage of water and air. Alluvium, commonly found on the banks of rivers, and composed of ingredients washed down from a variety of sources and intimately mixed, is usually excellent soil. Suitable composts for plants in pots are noticed under "POTTING."

EXPOSURE AND ASPECT OF THE GARDEN.

In selecting the situation of the garden, it is of importance to have protection from high wind, and, if necessary, this should be secured by planting trees at a distance of fifty yards from the site of the proposed garden; the object being to break up strong currents, but not to prevent gentle breezes. A garden with a still atmosphere is adapted for plants having large leaves, the flowers being usually proportionately small, and is the favourite haunt of the mosquito. A gentle breeze is specially suitable for plants with large flowers and brilliant colours.

As regards *Aspect*, in the tropics of the northern hemisphere, a point between east and north is desirable, and the converse holds on the southern side of the equator. For evidence on this matter, examine the

side of the house sheltered from ardent sunshine; note the luxuriant climbers and rich blossoms of the passion-flowers, of combretum, bignonia, and ipomœa; then inspect the exposed side, where few plants can bear the intensified heat of the sun. This extreme case—of the vertical walls of a house—differs only in degree from the open garden, sloping in one instance to the north and in the other to the south.

CAPILARITY OF SOILS.

If two clean sheets of glass be placed at one side in contact, but at the opposite side be kept apart by the thickness of this paper, and being held together by bandages, are placed vertically in coloured water, a quarter-inch in depth, the water will be seen to rise between the sheets, forming an elegant curve, highest at the point of apparently actual contact, and lowest at the side of greatest aperture. This shows how, in compact soils, water rises and escapes by evaporation, and the loss from this cause has been found by Mr. Ridgeway, Wyoming, U.S.A., to be retarded 19 per cent., from a water-level twenty-two inches beneath the surface, by stirring the surface weekly two inches in depth. This shows especially the need for keeping the surface loose between the lines of growing crops. Moreover, the air is frequently charged with moisture, and entering a loose soil finds at little depth a cool layer, which causes a deposition of further moisture from the atmosphere.

MEASUREMENT OF LAND.

The Indian Government system, of which the acre is the unit, is widely adopted.

1 link,	=	7.92 inches.
100 sq. links,	=	1 sq. chain.
10 sq. chains,	=	1 sq. acre.
Bigha of Poona, ..	=	40,332 sq. feet.
Pand „ ..	=	1,003½ „
Bigha of Tirhoot, ..	=	38,025 „
„ „ Bengal, ...	=	14,400 „
„ „ Benares, ...	=	28,224 „
„ „ N.-W. Provinces, =	=	27,225 „
„ „ Orissa, ...	=	43,560 „

BRITISH IMPERIAL LAND MEASURE.

9 sq. feet,	=	1 sq. yard,	=	$\frac{1}{4840}$ acre.
30½ sq. yards,	=	1 sq. pole, perch,		
		or rod,	=	$\frac{1}{160}$ acre.
160 rods or poles, =	=	1 rood,	=	$\frac{1}{4}$ acre.
4 roods,	=	1 acre,	=	$\frac{1}{640}$ sq. mile.

AVOIRDUPOIS WEIGHT.

16 ounces,	=	1 pound (lb.).
112 pounds,	=	1 hundredweight (cwt.).
20 hundredweight, =	=	1 ton.

1 ton per acre IS EQUAL TO 2 cwt. per sq. chain;
5 cwt. per rood; 14 lbs. per sq. pole or perch; and
7½ oz., nearly, per sq. yard.

CLIMATE.

A CAREFUL study of the climate of the countries within the limits of this work—that is, $33\frac{1}{2}^{\circ}$ north and south of the equator, or 10° beyond the true tropical zone, but as nearly as possible to the limits of tropical horticulture—shows a remarkable similarity. Our limits are nearly coextensive with the region in which the south-west and the north-east monsoons prevail, and there is little difference of weather between the several countries concerned. A long, nearly rainless season in the early months of the year, with occasional thunderstorms; followed by the south-west monsoon, opening near the beginning of June and extending to the end of September; followed by an interval of about a month in October; then the north-east monsoon takes up the duty, and extends a reduced rainy season until the beginning of February, but in South America and Annam the north-east monsoon is the stronger.

The mean temperature of the coast-lands within about a hundred feet from the level of the sea, varies from 70° to 90° in the shade. Without shade, the temperature at mid-day is 50 to 60 degrees higher. At five thousand feet altitude, the temperature in the shade is 65° to 75° , with the same insolation or noon temperature if exposed to the sun's rays, but one generally feels it much less owing to the dryness of the atmosphere.

The vegetable products have also a striking similarity. Rice, sugar-cane, and bananas are cultivated wherever irrigation, or other source of moisture in addition to the periodical rainfall, is available. From the middle of the south-west monsoon in August, onward through the cool season, European vegetables thrive, and onion and potato crops abound in gardens.

CEYLON CLIMATE.

STATIONS.	North Latitude.	East Latitude.	Altitude in feet.	Rain (cents omitted).	Mean Temp.	Rainy Days.
	° ' "	° ' "		Inches.	Degrees.	
Anuradhapura,	8 23	80 23	295	54	80	104
Badulla, ...	...	...	2225	80	73	111
Bathicoloa, ...	...	...	26	55	80	102
Colombo, ...	6 56	79 59	40	88	80	173
Galle, ...	6 0	80 15	48	91	79	206
Hakgalla, .. *	...	...	5581	91	60	203
Hambantota,	...	...	50	36	79	85
Jaffra, ..	9 38	80 3	9	44	81	74
Kanda, ...	7 18	80 41	1654	82	75	193
Karangala, ...	...	...	381	84	79	172
Mannar, ...	...	79 0	12	38	81	67
Nuwara Eliya,	..	..	6188	94	57	202
Pattalam, ...	...	...	27	46	79	77
Ratnapura, ...	...	...	84	150	79	207
Trincomalee,	8 34	81 12	12	63	81	112
Vavumixya, ...	...	...	317	59	80	100

Table showing Latitude, Longitude, Altitude, and Average Monthly and Annual Rainfall at Important Stations in India, Burma, and Ceylon, in inches and Cents.

STATIONS.	North Latitude.	East Longitude.	Altitude Above Mean Sea Level.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average Yearly Rainfall.
Agra, ...	27 10	78 5	555	0.55	0.33	0.25	0.16	0.64	2.84	9.67	7.11	4.41	0.39	0.06	0.29	26.70
Ahmedabad, ...	23 1	72 37	163	0.02	0.10	0.01	0.03	0.46	3.94	11.49	8.26	4.42	0.55	0.19	0.05	29.52
Allahabad, ...	25 26	81 52	309	0.82	0.48	0.38	0.14	0.26	5.09	12.24	10.88	6.32	2.40	0.25	0.23	39.52
Amritsar, ...	31 37	74 55	756	1.28	1.18	0.82	0.55	0.80	2.27	7.78	6.53	2.51	0.40	0.18	0.62	24.92
Anungabad, ...	19 54	75 22	1905	0.14	0.10	0.07	0.20	0.75	6.18	7.04	5.33	6.83	2.26	0.60	0.60	30.10
Bangalore, ...	12 59	77 38	3021	0.06	0.22	0.72	1.19	4.53	3.13	4.13	6.00	7.11	6.74	2.61	0.39	36.83
Baroda, ...	22 18	73 16	105	0.01	0.14	0.02	0	0.36	5.76	13.80	10.35	6.23	0.69	0.16	0.03	37.65
Belgaum, ...	15 52	74 42	2539	0.06	0.03	0.49	2.05	2.73	9.32	15.37	9.15	4.05	5.09	1.33	0.24	49.91
Benares, ...	25 20	83 2	267	0.74	0.51	0.33	0.15	0.56	5.45	12.54	11.19	6.54	2.24	0.17	0.17	40.59
Bolarum, ...	17 31	78 34	2000	0.10	0.19	0.54	0.61	1.05	3.72	6.55	7.10	5.87	3.01	0.94	0.31	29.99
Bombay (Byculla), ...	18 58	72 52	17	0.14	0.03	0.01	0.03	0.39	21.81	28.00	17.12	12.76	2.30	0.19	0.04	82.72
Calcutta (Alipore), ...	22 32	88 20	21	0.29	1.02	1.14	1.54	5.60	11.04	12.31	12.69	10.40	3.87	0.62	0.31	60.83
Cawnpore, ...	26 26	80 25	416	0.74	0.44	0.23	0.12	0.83	3.59	10.29	9.89	5.01	1.18	0.24	0.24	32.29
Cherrapongee, ...	25 16	91 47	4309	0.74	2.16	11.08	32.24	51.53	105.12	109.49	76.50	33.25	13.97	1.49	0.23	437.80
Chittagong, ...	22 21	91 50	87	0.41	1.16	2.14	4.47	9.68	22.81	22.92	19.99	13.03	6.41	1.49	0.58	105.09
Colombo, ...	6 56	79 52	40	3.24	1.89	4.57	11.43	12.10	8.35	4.46	3.81	4.98	14.36	12.55	6.35	88.27
Darjeeling, ...	27 3	88 18	7376	0.76	1.08	2.01	4.08	7.83	24.19	31.74	25.98	18.34	5.35	0.24	0.20	121.80
Deesa, ...	24 16	72 14	466	0.14	0.14	0.08	0.05	0.19	2.28	9.32	7.77	3.54	0.58	0.14	0.05	24.28
Delhi, ...	28 40	77 16	718	1.02	0.61	0.67	0.35	0.71	3.18	8.38	7.44	4.42	0.39	0.10	0.43	27.70
Dharwar, ...	15 27	75 3	2586	0.11	0.03	0.33	1.65	2.98	5.15	6.26	4.61	3.98	5.76	1.74	0.37	32.97
Darbhanga, ...	26 10	86 0	166	0.65	0.45	0.37	0.69	2.59	7.66	12.13	12.24	9.33	2.80	0.07	0.11	49.09

Table showing Latitude, Rainfall, etc. (continued).

Station.	North Latitude.	East Longitude.	Altitude Above Mean Sea Level.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average Yearly Rainfall.
Hydrabad (Deccan), Do. (Sindh), ..	17 23	78 31	1690	0.09	0.09	0.54	0.68	0.80	4.40	5.91	6.56	6.89	3.29	1.25	0.40	30.90
Indore, ..	25 25	68 27	96	0.25	0.20	0.13	0.16	0.12	0.43	2.62	3.08	0.52	0	0.10	0.05	7.66
Jampur, ..	22 44	75 53	1823	0.25	0.24	0.05	0.17	0.47	6.33	9.76	7.75	7.46	1.09	0.24	0.18	33.99
Jampur, ..	26 55	75 50	1431	0.43	0.19	0.31	0.16	0.64	2.96	8.90	7.44	3.23	0.21	0.16	0.85	24.98
Jubbulpore, ..	23 9	79 59	1327	0.72	0.52	0.48	0.22	0.47	8.53	18.82	15.13	8.58	1.55	0.37	0.26	55.45
Kandy (Paradenia), Kolhapur, ..	7 18	80 40	1654	4.94	2.40	3.43	7.19	6.11	9.13	7.04	5.91	5.75	11.98	10.48	9.11	83.47
Kolhapur, ..	16 42	74 16	1797	0.06	0.09	0.14	1.40	2.29	7.39	12.54	7.16	4.19	5.10	0.84	0.19	41.30
Kurracher, ..	24 47	67 4	30	0.65	0.30	0.16	0.13	0.03	0.47	3.06	1.73	0.64	0.04	0.16	0.19	7.57
Kyawkse, ..	21 32	96 12	...	0.19	0.07	0.12	1.23	4.50	3.65	2.29	3.71	6.27	3.68	1.48	0.27	27.46
Lahore, ..	31 34	74 20	702	0.87	1.13	0.89	0.51	0.80	1.86	6.65	4.88	2.10	0.43	0.11	0.47	20.70
Lanault, ..	18 44	73 27	2037	0.06	0.04	0.06	0.23	0.65	28.81	69.51	46.02	29.39	3.76	0.72	0.15	172.40
Lucknow, ..	25 50	81 0	308	0.90	0.45	0.32	0.11	0.91	5.34	11.39	11.32	6.61	1.33	0.08	0.44	39.20
Madras, ..	13 4	80 14	32	0.83	0.28	0.37	0.65	1.96	2.06	3.80	4.60	4.84	10.93	13.30	5.25	48.93
Maubleswar, ..	17 55	73 43	4540	0.31	0.05	0.30	1.26	1.36	47.55	105.06	72.57	31.97	5.55	1.23	0.32	267.53
Maudalay, ..	21 59	96 8	250	0.06	0.08	0.21	1.19	5.26	5.71	3.26	4.16	6.21	4.54	1.67	0.28	32.63
Meerut, ..	29 0	77 41	738	1.05	0.83	0.63	0.34	0.70	3.60	9.37	7.64	4.55	0.43	0.08	0.40	29.62
Mount Abu, ..	24 36	72 45	3945	0.27	0.31	0.15	0.08	0.97	5.59	22.05	21.51	9.58	1.46	0.28	0.24	62.49
Mussooree, ..	30 28	78 7	6705	2.93	3.00	2.37	1.46	2.45	10.38	30.46	31.84	10.06	0.95	0.42	1.23	97.55
Mysore, ..	12 18	76 42	2518	0.07	0.17	0.64	2.46	5.38	2.08	2.31	3.10	4.26	6.68	1.80	0.43	29.37
Nagpur, ..	21 9	79 11	1025	0.58	0.42	0.57	0.46	0.68	8.44	13.49	9.79	8.11	2.14	0.51	0.48	45.62
Naini Tal, ..	29 23	79 31	6400	3.11	2.99	2.26	1.55	2.63	15.13	27.00	25.35	11.87	2.04	0.25	1.51	97.55
Nasik, ..	20 0	73 50	1962	0.07	0.06	0.03	0.14	0.65	5.94	7.84	9.96	5.36	3.45	0.48	0.22	29.28
Neemuch, ..	24 25	75 0	1730	0.19	0.15	0.09	0.13	0.45	4.63	9.72	9.96	5.36	0.64	0.17	0.27	31.76
Nasirabad, ..	26 18	74 47	1461	0.17	0.31	0.11	0.07	0.54	1.97	6.86	6.03	2.81	0.22	0.18	0.31	19.58
Ootacamund, ..	11 24	76 44	7250	0.35	0.38	1.00	3.46	5.93	6.18	5.94	4.70	4.44	8.57	4.00	1.65	46.60

Table showing Latitude, Rainfall, etc. (continued).

Station.	North Latitude.	East Longitude.	Altitude Above Mean Sea Level.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average Yearly Rainfall.
Patna, ...	25 37	85 14	183	0.72	0.53	0.35	0.30	1.70	7.76	11.41	10.72	7.82	2.89	0.20	0.14	44.54
Poona, ...	18 20	74 10	1840	0.18	0.05	0.13	0.58	1.45	5.35	6.90	4.03	4.43	4.11	0.85	0.20	28.26
Prome, ...	18 48	95 18	128	0.02	0.01	0.02	0.82	5.40	8.01	9.19	9.52	7.11	4.52	1.75	0.07	47.24
Quetta, ...	30 11	67 3	5502	1.90	2.11	1.80	1.05	0.43	0.18	0.47	0.51	0.11	0.08	0.38	0.97	9.99
Rangoon, ...	16 46	96 12	57	0.11	0.23	0.16	1.74	11.73	18.30	21.37	9.65	15.89	7.12	2.52	0.07	98.89
Rawalpindi, ...	33 38	73 5	1576	2.50	2.10	2.09	2.05	1.42	1.79	8.24	7.71	3.18	0.53	0.64	1.11	33.36
Saharanpur, ...	29 57	77 36	903	1.47	1.34	0.94	0.36	0.73	4.61	12.26	10.32	4.81	0.45	0.22	0.68	38.19
Salem, ...	11 39	78 12	940	0.26	0.23	0.80	2.04	4.55	2.95	3.70	6.03	6.51	6.83	2.88	0.92	37.70
Sandoway, ...	18 28	94 25	50	0.08	0.07	0.10	1.07	13.34	49.18	61.78	48.05	24.17	9.81	2.71	0.29	210.65
Secundrabad, ...	17 27	78 33	1787	0.23	0.23	0.72	0.69	1.28	3.78	6.03	6.09	5.50	3.14	0.95	0.20	28.84
Shevaray Hills (Vercand), ...	11 52	78 13	4500	0.38	0.48	0.76	2.58	6.15	5.42	7.23	9.96	9.65	10.34	6.25	3.27	62.57
Simla, ...	31 6	77 12	7224	3.21	3.07	2.48	2.32	3.71	7.84	18.42	17.87	6.17	1.19	0.41	1.28	67.97
Surat, ...	21 13	72 46	39	0.03	0.07	0	0.01	0.15	9.46	15.44	0.82	6.39	1.57	0.15	0.03	42.22
Sylhet, ...	24 53	91 55	140	0.37	1.48	6.25	13.92	21.83	32.17	25.39	25.39	20.55	7.90	1.12	0.27	156.66
Umballa, ...	30 21	76 52	892	1.53	1.58	0.86	0.55	0.86	4.09	11.01	8.74	4.50	0.44	0.24	0.67	35.07
Wellington, ...	11 22	76 50	6200	1.12	1.41	2.17	3.95	3.84	3.39	3.33	3.85	5.56	10.57	7.10	3.82	50.11

Table showing the Mean Temperature at the Principal Stations in India, Burma, and Ceylon.

STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	Septem.	October.	Novem.	Decem.	Yearly Average.
Aggra, ...	60.1	64.8	70.7	88.1	84.0	93.4	80.0	84.2	84.2	79.4	68.7	61.2	78.4
Allahabad, ...	59.5	64.9	70.8	87.6	82.5	90.8	84.5	83.2	83.0	77.6	67.5	61.2	77.3
Bangalore, ...	67.3	72.0	76.7	79.9	78.5	74.0	72.0	71.8	71.8	71.8	69.6	67.5	72.8
Bellary, ...	73.2	79.6	85.6	89.2	89.0	83.4	80.9	80.6	80.2	79.1	75.3	72.5	80.8
Benares, ...	60.0	65.3	70.6	80.8	81.3	82.4	84.1	83.1	83.0	77.9	67.8	60.2	77.2
Bombay, ...	74.5	74.8	78.9	82.1	84.6	84.5	79.4	79.4	82.6	80.0	72.4	65.3	77.9
Calcutta (Alipore), ...	65.2	70.3	73.3	82.0	81.0	80.4	83.0	80.5	80.4	79.3	70.5	72.9	80.2
Colombo, ...	79.0	79.7	80.6	81.5	82.1	80.4	80.0	80.5	83.0	81.1	74.2	68.6	80.3
Cuttack, ...	70.2	75.8	82.5	87.3	88.6	86.4	83.0	82.4	83.0	78.5	67.8	61.8	82.7
Darjeeling (St. Paul's School), ...	40.1	41.6	49.7	60.2	68.2	79.9	61.5	61.5	60.9	55.2	47.8	41.8	52.7
Dessa, ...	57.4	62.2	74.1	86.2	91.7	92.2	86.4	84.5	83.9	78.5	67.6	59.6	77.1
Delhi, ...	67.1	70.9	80.3	86.9	91.7	91.7	88.6	87.7	86.0	82.7	70.7	63.4	79.9
Darbhanga, ...	63.6	67.1	77.6	86.2	91.6	91.7	88.6	86.0	86.0	82.7	73.4	65.0	75.3
Hydrabad (Sindh), ...	64.1	67.5	76.3	87.5	83.6	90.4	84.7	82.3	82.4	77.9	68.9	61.5	77.1
Jaipur, ...	70.9	64.2	74.9	86.3	91.6	91.9	83.0	81.9	82.9	80.0	70.8	63.9	79.2
Jhansi, ...	62.8	67.6	79.4	90.4	95.6	91.9	85.7	83.0	83.0	77.9	64.6	57.4	73.6
Jubbulpore, ...	61.8	66.8	76.5	86.3	91.9	91.9	79.0	78.0	79.0	74.9	64.6	57.4	73.6
Kandy, ...	37.2	75.0	77.3	77.5	78.6	77.5	74.9	74.9	74.9	75.2	72.3	73.4	75.5
Karnachee, ...	53.0	57.3	65.0	80.6	84.7	90.8	84.3	82.4	82.0	74.0	67.4	67.4	77.6
Lahore, ...	58.7	63.7	69.0	80.9	85.9	93.6	89.1	87.1	84.8	80.0	68.2	54.6	74.7
Lucknow, ...	75.3	76.6	79.7	86.4	90.6	90.2	85.3	83.4	83.4	77.1	66.3	58.9	81.8
Madras, ...	68.8	73.3	81.8	89.2	88.7	88.4	85.3	84.5	83.9	80.8	75.0	68.5	80.8
Mandalore, ...	68.8	73.3	81.8	89.2	88.7	88.4	85.3	84.5	83.9	80.8	75.0	68.5	80.8
Meerut, ...	56.0	60.1	71.1	82.7	88.4	89.4	85.0	83.2	81.7	74.7	63.5	56.7	74.4
Mount Abu, ...	55.6	60.1	71.1	82.7	88.4	89.4	85.0	83.2	81.7	74.7	63.5	56.7	74.4
Naryanganj (Dacca), ...	65.8	69.0	78.2	82.6	82.3	82.2	83.4	82.9	83.4	77.6	69.2	67.6	78.0
Nearu Bilya, ...	65.8	69.0	78.2	82.6	82.3	82.2	83.4	82.9	83.4	77.6	69.2	67.6	78.0
Panna, ...	57.8	62.2	76.9	86.2	90.7	90.7	85.0	83.2	81.7	74.7	63.5	56.7	74.4
Poonna, ...	68.8	73.3	81.8	89.2	88.7	88.4	85.3	84.5	83.9	80.8	75.0	68.5	80.8
Quetta, ...	39.0	42.2	52.6	60.9	65.6	74.1	74.9	73.7	74.4	76.5	72.5	68.9	75.9
Rangoon, ...	74.7	77.7	81.2	87.0	89.2	89.2	83.4	82.9	83.4	77.6	69.2	67.6	78.0
Rawalpindi, ...	48.6	52.0	62.9	73.8	82.1	88.7	86.1	83.7	80.3	70.6	58.3	50.2	69.9
Salen, ...	75.0	78.5	83.3	88.4	95.9	91.2	80.2	80.2	80.3	78.5	70.8	75.0	80.3
Sholapur, ...	72.7	77.7	84.2	88.4	95.9	91.2	80.2	80.2	80.3	78.5	70.8	75.0	80.3
Simla, ...	38.8	40.6	51.5	59.3	66.0	66.9	64.3	62.8	60.9	56.7	50.1	43.4	55.1
Surat, ...	70.6	73.5	79.7	85.5	87.1	85.3	80.8	80.7	80.9	80.6	75.9	71.8	79.4
Wellington, ...	55.6	58.8	63.5	66.5	67.2	64.3	64.1	63.8	63.3	62.0	50.2	56.3	65.0

Table showing temperatures in India, Burma, and Ceylon.

STATIONS.	October.		November.		December.		During Year.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
	°	°	°	°	°	°	°	°
Agra,	107·7	53·1	96·0	39·4	86·0	38·3	120·3	30·0
Allahabad,	106·7	52·9	96·1	39·7	87·1	36·4	119·8	36·0
Bangalore,	90·9	55·9	87·3	51·4	86·5	48·2	100·8	45·8
Belgaum,	93·8	54·9	90·3	50·0	38·6	49·0	108·2	43·6
Benares,	105·9	50·0	95·3	40·0	86·7	33·0	120·0	30·0
Bombay,	95·0	70·0	95·6	64·3	91·3	63·0	98·5	55·9
Calcutta (Alipore), ...	93·7	63·2	90·2	51·1	85·4	45·0	108·2	44·2
Coimbatore,	96·9	62·1	95·3	57·2	95·4	54·2	104·3	54·0
Colombo,	93·0	67·8	92·0	64·0	93·5	66·8	100·0	64·0
Cuttack,	101·8	63·0	96·8	49·6	90·7	48·1	118·0	48·6
Darjeeling (St. Paul's School),	68·7	41·7	63·1	30·8	59·8	26·7	80·1	19·9
Deesa,	108·1	51·4	103·1	41·1	95·6	39·5	119·4	34·1
Delhi,	106·1	54·4	94·7	41·3	85·2	38·3	118·0	35·2
Darbhangha,	94·0	61·8	90·4	51·1	83·1	44·3	107·4	38·3
Hydrabad (Singh), ...	117·2	55·4	100·7	44·1	92·1	38·8	122·2	36·0
Indore,	100·1	47·7	94·7	41·7	90·7	36·6	112·7	36·1
Jacobabad,	108·9	47·2	99·5	32·7	89·5	31·6	126·0	29·0
Jaipur,	104·2	49·4	97·2	42·2	88·2	34·5	117·5	33·0
Jhansi,	108·0	50·0	98·2	42·3	91·7	40·7	119·2	37·3
Jubbulpore,	98·0	46·3	93·5	32·0	87·9	32·3	114·8	32·0
Kurrachee,	107·9	57·0	99·9	47·9	90·4	41·0	117·6	40·1
Lahore,	106·5	46·3	92·3	32·5	86·6	29·8	120·3	29·2
Lucknow,	105·8	51·7	94·9	36·4	91·8	34·2	119·0	30·0
Madras,	99·1	62·1	94·8	59·5	94·8	57·5	112·9	57·5
Mandalay,	100·5	62·2	96·5	55·7	92·5	45·1	111·1	45·1
Meerut,	103·5	50·0	98·0	36·1	84·0	34·1	117·0	31·0
Mount Abu,	88·3	55·4	83·2	44·7	78·9	37·3	101·0	32·8
Nagpur,	101·1	57·3	96·1	39·4	92·1	42·1	117·7	39·4
Neemuch,	102·5	50·9	96·0	40·1	88·0	36·5	115·1	31·2
Patna,	102·6	59·1	93·9	44·2	82·8	40·8	114·4	36·4
Poona,	100·0	53·9	96·5	43·0	95·0	42·9	110·0	40·8
Quetta,	89·1	23·9	79·7	14·0	73·3	10·8	102·3	3·3
Rawalpindi,	99·8	42·0	88·0	25·9	82·0	23·9	118·0	23·9
Salem,	98·5	62·9	99·7	55·0	94·4	55·5	108·4	55·0
Simla,	77·3	30·0	73·3	31·6	70·3	21·0	94·4	19·2
Surat,	106·2	58·0	102·2	46·3	97·7	45·3	114·0	42·8
Wellington,	75·2	42·2	72·7	37·2	77·0	34·9	83·4	24·7

*Average Monthly Mean Temperatures of the Ground at the Surface and at a Depth
of Three Feet.*

STATION.	Number of Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly Mean.
Lahore ... { Surface, ... { 3 feet deep,	17-18 17 18	50.4 62.8	57.4 63.3	74.5 70.0	90.2 78.9	101.3 86.5	104.6 91.5	101.2 92.9	99.2 92.6	95.6 91.9	78.8 85.6	61.2 76.3	51.3 67.7	80.5 80.0
Jaipur ... { Surface, ... { 3 feet deep,	21-22 21-22	63.1 66.8	70.0 68.0	83.8 74.5	95.2 82.0	101.7 87.7	100.7 91.2	92.1 88.8	89.9 86.7	91.7 87.0	85.6 85.1	72.6 78.2	63.8 71.0	84.2 80.6
Dehra .. { 1.1 feet deep, { 3.2 feet deep,	21-22 21-22	97.4 62.0	59.1 61.4	68.0 67.1	78.8 75.8	86.5 82.5	88.4 85.1	84.4 83.6	82.5 82.2	81.5 81.8	76.4 78.4	67.7 72.1	60.3 65.9	74.3 74.8
Allahabad, { Surface, ... { 3 feet deep.	22-23 22-23	59.6 66.7	65.6 68.1	81.0 74.2	92.8 82.5	102.1 89.3	99.4 92.2	88.9 88.3	87.3 86.3	87.6 86.0	81.2 83.5	67.9 76.8	59.0 70.0	81.0 80.3
Calcutta (Alipore) { Surface, ... { 3 feet deep.	23 22-23	76.2 72.1	85.0 73.8	102.1 78.9	111.5 84.7	106.9 87.4	97.8 87.3	93.8 86.4	93.2 86.1	94.1 86.0	93.0 85.1	85.7 80.9	77.0 74.9	93.0 82.0

Table showing the Nocturnal Radiation and Mean Isolation at a few Important Stations.

STATION.	Altitude above Mean Sea Level in feet.	* NOCTURNAL RADIATION.		† MEAN ISOLATION.
		January.	July.	
		°	°	°
Mount Abu, ...	3,945	16·5	1·9	59·1
Bombay,	37	10·1	2·2	51·9
Calcutta (Alipore),	21	8·2	1·8	54·1
Delhi,	718	8·7	3·8	54·7
Poona,	1,840	13·2	3·9	54·0
Kurrachee, .	30	8·5	2·3	66·7
Lahore,	702	9·3	3·8	55·9
Mangalore,	65	7·1	1·9	59·7
Nagpur,	1,025	13·4	2·9	58·3

* Decrease of temperature obtained by exposing the thermometer to the sky as compared with the temperature in the shade.

† Excess of heat produced by full exposure to the sun as compared with the shade temperature.

MANURE.

MANURE may be defined as matter capable of increasing the fertility of the soil. From the earliest records of cultivation, decaying organic matter has been used for this purpose, and chemical investigation has shown that of the components of the ordinary manure heap only a small proportion is taken up by the plants—NITROGEN, PHOSPHORIC ACID, POTASH, and, rarely, LIME, being the only constituents required by plants that are scarce in soils.

The mixed refuse of the farmyard, termed “farm-yard manure,” has—

Nitrogen,	9 to 15 lbs.	per ton of 2240 lbs.
Phosphoric acid, 9 to 15 lbs.	„	„
Potash,	4 to 9 lbs.	„

The vegetable matter of farmyard manure is valuable because by decay it gives off carbonic dioxide, which assists in the solution of lime and other carbonates, and its mineral matter being in the minute state of division which favours solution, and also by its decomposition, it maintains a supply of HUMUS, which, in small proportion, is present in all fertile soils—its function being probably the maintenance of *bacteria* and *fungi*, which unquestionably affect soil fertility.

It is found by experiment that abundant nitrates in soil encourage the development of leaf and shoot; phosphates especially assist the formation of seed; and potash of hydrocarbons, such as sugar, starch, and cellulose.

The quantity of farmyard manure which may be used with profit varies greatly with soil and climate. Three bushels or head-loads per hundred square feet is the quantity recorded by PLINY as used in his time. That may be assumed to be nearly twenty-two tons

per acre—a fair allowance for general irrigated crops or abundant rainfall. In hot climates, without irrigation, half that quantity is a safe application; and for bananas or sugarcane, double—or forty-four tons per acre—may be used with profit. If farmyard manure has been exposed during the rainy season, when the dung beetle lays its eggs, the manure may contain large grubs which injure the roots of plants. Such manure may be spread out, soaked with lime-water, and left for a time for the birds to gather up the grubs which come to the surface. When in good condition, this manure is moist, red in colour, and has a pungent odour.

TREATMENT OF FARMYARD MANURE.—When farmyard manure is collected in a heap, and is moistened slightly, it ferments and becomes hot, and the pungent odour indicates the escape of carbonate of ammonia. This gas is largely composed of combined nitrogen, the most costly ingredient in manure, and if means be not taken to arrest the escape of this gas, in a short time the heap of manure will have lost about one-half of its commercial value—as the Maratha gardener laconically says, "*Tiacha jiv gela*" "Its life is gone!" How to prevent this loss of ammonia is a question which has to be considered in view of local circumstances. The market-gardeners near London, whenever possible, put the manure into the ground daily as it is received. This induces a slow fermentation, in which there is the least possible loss. The rice-grower on the Western Ghats, with the same object, dries his cow-dung by spreading it on rocks in the sun. In this case carbonate of ammonia is not formed, and the subsequent burning of the manure on his seed-bed leaves a residue rich in plant food.

The British farmer keeps his dunghill moist—an easy task under a dripping sky. When kept thoroughly moist, other combinations of ammonia with humic acid and ulmic acid are formed, which in water ooze

from the dunghill as a black liquid, and by careful cultivators is thrown back, to be absorbed by the decaying litter.

Wherever irrigation is used freely, manure may be used in a fresh state with economy, but in dry soils, or for pot plants, it has a burning effect, caused by ammonia, as such; to become plant food it must combine with oxygen to become nitric acid, and this in turn must join with an alkali (lime, potash, soda, etc.) to form a safe and soluble vehicle of nitrogenous plant food.

The chemical changes which manure undergoes have been proved to be set in progress by bacteria—one set aiding the union of nitrogen with other substances, thus improving the manure; but when a definite stage is reached, another set reverse the process, and set nitrogen free to become again the inert gas which makes nearly four-fifths of the atmosphere. Hence manure does not constantly improve by age, but may be kept too long, and the practical application is: put the manure into use as early as possible. In tropical countries, it is at its best when six months old if kept moist.

CHARCOAL DUST is valuable for keeping soils open; and if kept in contact with manures, it will absorb the ammonia given off and facilitate its conversion into nitric acid preparatory to acting as manure. It is not soluble, and although not a manure of itself, it is a valuable auxiliary in composts.

FISH GUANO, formed of fish offal or small fish dried quickly and ground, is a concentrated manure which repays carriage a considerable distance, and is of special value in hot climates. A sample prepared by the writer, and submitted to Dr. Voelcher, proved to have organic matter 60·09 per cent.; containing nitrogen, equal to ammonia, 10·38 per cent., and phosphoric acid, equal to tribasic phosphate of lime, 19·45 per cent.

GREEN MANURE.—When a piece of ground has been prepared for a crop well in advance of the necessary time, as is desirable, heavy rain may cause loss by washing nitrates from the soil. This may be prevented, and positive benefit obtained by sowing thickly seed of *tag* or *sunnn*, *indigo*, or almost any other member of the pea and bean family which is locally procurable cheaply. By the aid of bacteria, such crops assimilate nitrogen from the atmosphere, and the green crop being dug into the soil, rapidly decomposes and enriches it.

BONE MANURES.—Dry bones contain about half their weight of phosphate of lime, with a small proportion of nitrogen, which varies with the time the bone has been exposed to the weather; boiling or burning also dissipates the nitrogen, as long exposure does, leaving only pure mineral matter, which is very slowly acted upon by the roots of plants, and unless it be cheap and capable of use in large quantities and over a long series of years—such as in planting fruit-trees—it is necessary to dissolve the bone for use as manure. Should there not be a manure factory at hand, the bones may be burned, and the ash placed in a glazed earthenware vessel or lead-lined box; then sulphuric acid equal to one-third the weight of the bone may be diluted with an equal weight of water (*the acid to be gently added to the water*). This dilute acid may be sprinkled on the bones, and stirred with a stick at intervals for a few days; the mass will then be slimy superphosphate of lime, and may be made friable by the addition of ashes, sawdust, or other dry substance which does not contain lime in high proportion. Bone manure is of special value when fruit or seed is the object of cultivation, such as tomato, grape, cucumber, melon, banana, pea, bean, and grain cultivation, and also for turnip and Lucerne crops; but for all plants of rapid growth, it must be supplemented by a manure supplying nitrogen and potash, such as crude saltpetre, poudrette, cow-dung, etc. A sufficient application of dissolved bones is about 6 cwt. per acre, or $1\frac{1}{2}$ lbs. per ten square yards.

Sulphate of ammonia, saltpetre, and nitrate of soda are valuable sources of nitrogen, but apt to be washed out of soils by tropical showers.

OIL-CAKE MANURE.—Oil-cakes are stimulating manures, valuable in inverse proportion to the presence of oil and marc. Castor-oil-cake and rape-cake may be used as manure when procurable cheaply.

POUDRETTE, as prepared in India by mixing fresh excreta with ashes obtained by burning town sweepings, is shown by analysis to be twice the value of farmyard manure, but, from its powdery condition, it is practically of higher value than its analysis discloses.

LEAF-MOULD.—Leaf-mould is a useful manure produced by storing garden sweepings in a moist pit until the leaves break freely when sifted. The time necessary to prepare the manure depends on the degree of moisture, the temperature, and the bulk of the mass. Although it causes a loss of nitrogen, high fermentation is desirable to destroy the seeds and roots of weeds that may be in the pit, and a regular system of filling the pits is desirable, so that one pit may not contain decayed and lately gathered material at one time, and waste labour in the removal of the decayed portion. Several pits in inobtrusive parts of the garden may be prepared, and all sweepings taken to one pit only at a time. When one pit is filled and heaped three feet above the surface, a covering of soil should be applied and the irrigation water turned on frequently. When the mass has sunk to the surface level, it will be found ready to dig out, and after a few days' exposure on the surface will be ready for use. Leaf-mould contains much of the mineral food of plants readily soluble, and as it retains moisture and beneficial bacteria, it is useful in a compost for seed-sowing and the propagation of soft-wooded plants, but it is not a stimulating manure.

LIQUID MANURE.—Wherever practicable, a tank should be prepared, through which a small stream of water may be passed and returned to the irrigation water-channel. Into this tank crude manure may be placed to soak, and the clear infusion passing into the irrigation stream will convey the nutrient matter in the soluble form capable of being utilised at once by growing crops, to their evident advantage; but if the tank be stirred, and a muddy stream delivered, it may coat the surface of the soil and prevent the action of air until the soil be stirred with the hoe.

LIME.—In limited districts, lime may be scarce, and the soil may be tested with hydrochloric acid, which produces an effervescence that may be seen or heard if the soil be held near to the ear.

The most scientific way of valuing manure is to place a price on each unit in the percentage of valuable ingredients in the manure. The price must depend on the local cost of the cheapest manure containing a definite proportion of the valuable ingredients, and its value will depend on the local price obtainable for the produce. For example, the price of farmyard manure laid down in the field, about twenty miles from London, is about 8s. 6d. per ton, and the value assumed by authorities in England is nitrogen, 6d., phosphoric acid, 2d., and potash, 1d. per lb.; therefore

12 lbs. nitrogen at 6d. per lb., - - 6s. 0d.

8 lbs. phosphoric acid at 2d. per lb., 1s. 4d.

12 lbs. potash at 1d. per lb., - - 1s. 0d.

32 lbs. per ton scarce ingredients, value 8s. 4d. per ton.

The fact that nitrates are washed out of the soil by tropical showers accounts for the special need of frequent manuring in hot climates.

The Comparative Value of Manures by Units, on the basis of Cattle-Dung at 3 rupees or 4s. per ton.

With Nitrogen 3, Phosphoric Acid 1, and Potash $\frac{1}{2}$ an anna per lb.

		PER CENT.	R.	S.	P.
Cattle-Dung, ...	{ Nitrogen, ... Phosphoric Acid, ...	{ 0·77 0·63 }	0	4	2
Litter and Urine, ...	{ Nitrogen, ... Phosphoric Acid, ...	{ 0·46 0·29 }	0	2	6
Mowra Flower Cake, ...	{ Nitrogen, ... Phosphoric Acid, ...	{ 2·58 0·93 }	0	12	2
Castor Seed Cake, ...	{ Nitrogen, ... Phosphoric Acid, ...	{ 6·0 2·6 }	2	4	0
Karanja Seed Cake, ...	{ Nitrogen, ... Phosphoric Acid, ...	{ 3·36 0·75 }	1	12	1
Dried Fish, ...	{ Nitrogen, ... Phosphoric Acid, ...	{ 6·4 6·75 }	...		
Poudrette, ...	{ Nitrogen, ... Phosphoric Acid, ...	{ 1·00 0·85 }	0	2	9
Sheep Manure, ...	{ Nitrogen, ... Phosphoric Acid, ...	{ 1·12 4·21 }	0	6	6

“Who that has reason and his smell
Would not among roses and jasmines dwell,
Rather than all his spirits choke
With exhalations of dirt and smoke,
And all the uncleanness which does drown,
In pestilent clouds, a populous town.”

—*Conley.*

PROPAGATION.

SEED SOWING.

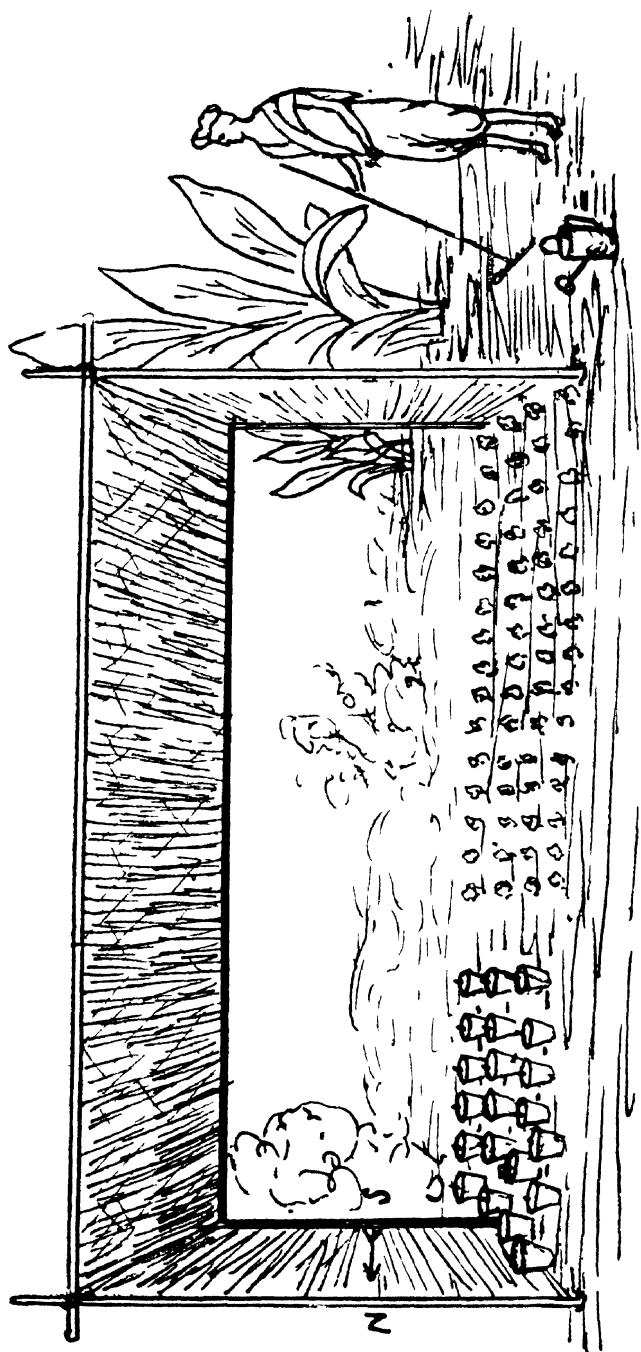
THE germination of seed requires a friable soil, retaining sufficient moisture to keep the seed in an equable condition, yet permitting excess to pass downward and draw air into the soil. For fine seeds in pots or beds, a mixture of equal parts leaf-mould and sand is generally suitable; and if silicious sand is not available, crushed brick or charcoal dust may be employed, and larger seeds sown in the open are benefited by a dressing of similar compost.

The seed bed should be thoroughly tilled well in advance, and smoothed on the surface before sowing, and the seed scattered thinly and as equally as practicable; then a thin coating of leaf-mould may be spread on the surface and pressed down firmly, so that the benefit of moisture brought to the seed by capillary attraction may be obtained. For evidence of the benefit of making the soil firm, observe the wheelmarks on an artillery parade ground at the beginning of the monsoon. The wheelmarks are green with germinating seed much earlier than the intervening space.

The illustration shows a contrivance that has proved very useful in the tropics. It breaks the strong sun rays, yet admits sufficient light for seed to germinate well. Observe that the south side is lower than the north side, causing heavy rain to run off. The covering may consist of cocoa-nut matting, or even of rushes.

PROPAGATION BY "CUTTINGS" OR "SLIPS."

The degree of assistance necessary to induce branches of a plant to form roots and begin an independent existence varies extremely. The prickly pear will root



SEED SHELTER

if a branch falls to the ground; many woody plants will root freely if the cuttings be planted in the shade and the soil be kept moist: but some require the highest skill in treatment, and many have completely foiled the ablest propagators. Regarding the rooting of cuttings, Pliny tells us that the end which lies nearest the earth should be inserted in the ground, and the length of time since his statement was written has not affected its fundamental truth!

The Essentials for Rooting Cuttings.

The properly selected cutting has, in its tissues, food material which it can change in form and cause growth of roots if it be supplied with sufficient moisture and protection from hot, dry air—in other words, if it be kept alive for a time. The degree of protection necessary is indicated in treating of particular plants, and if no special remarks appear, it may be assumed that extra assistance is unnecessary. For hardy shrubs and trees, “cuttings” of well-ripened wood, having three buds and trimmed close beneath the lowest bud, may be inserted two-thirds of the length in sandy soil, with shade, and if kept moist will take root. As a general rule, shoots which are well ripened and are taken from branches near the ground at a joint, *i.e.*, where one branch joins another, will be the most successful “cutting”; but some delicate hard-wooded plants, such as *Poivrea*, *Combretum*, and *Euonymus*, strike root more freely from half-ripened wood, and many soft-wooded plants, which are difficult to propagate in ordinary circumstances, strike root freely if “cuttings” be taken from near the root and are inserted with bottom-heat. Delicate “cuttings,” such as those of *Poivrea coccinia* and *Bougainvillea spectabilis*, should be planted in pots prepared as follows:—

PREPARATION OF POTS FOR “CUTTINGS.”—First potsherds should be placed at the bottom of the pot, arranged carefully so as to secure thorough drainage,

then a layer of moss or cocoa-nut fibre. On the top of this, place a mixture of leaf-mould and sand; let it come up to within two inches of the rim of the pot, add one and a half inches of sand or brickdust. The "cuttings" should be inserted in the top layer, barely touching the second one, so as to reduce the danger of rotting and have food ready for the young roots as soon as they appear. The whole should then be placed



SOFT-WOODED CUTTING
PREPARED FOR INSERTING.



HARD-WOODED CUTTING—
EUONYMUS JAPONICUS.

in a glass case or covered with a *bell-glass*, and the soil kept moist. A peg, proportionate to the size of the "cutting," should be used for making holes for its insertion, because the generative tissue at the end of the "cutting," is easily injured. Water should be applied freely in a gentle shower as soon as the "cuttings" are inserted, so as to bring the soil into close contact with the "cuttings," and an equable state of moisture should be maintained by gentle watering as frequently as signs of drought appear—the intervals may be daily or weekly according to circumstances.

SEASON FOR "CUTTINGS."—The cool season is generally most favourable, but in districts where the winter is cold autumn will be found more suitable for planting "cuttings."

BOTTOM-HEAT, or a ground temperature several degrees higher than the temperature of air, is found to induce the formation of roots on cuttings. It is found difficult in application in tropical gardens generally, but useful during the cool season, and especially in high altitudes. Where bottom-heat is required at considerable intervals, the "Hot-bed" is a convenient means of producing it, and explanatory notes are given under that heading.

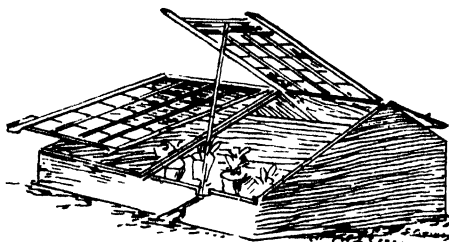
As an amusement, "cuttings" may be suspended in a bottle containing water sufficient to cover the lower ends of the "cuttings," and if the bottle be placed under a glass shade and placed in abundant light without direct sunshine, the formation of the root may be observed, but the growth produced in water is very tender, and requires particular care in transferring to soil.

ROOT "CUTTINGS."—Underground ramifications, commonly called roots but usually portions of the stem, are in some cases used as "cuttings" with great success. Species of *Clerodendron*, *Millingtonia*, *Ipecacuanha*, the *Potato*, *Ginger*, its allies, and many others, are of this nature.

LEAF "CUTTING."—Portions of leaves often develop buds and roots, and may be used for propagation. Many ferns, the *Tolmiea*, *Gesnera*, *Begonia*, and *Crassula* families, and many species of the *Lily* family, may be propagated this way.

Such as are known as *vivaparous plants* often produce young plant where one looks for seeds. If those young plants be set out, they begin to grow at once. An example of this is the well-known *Sisal* plant, one of the genus *Agave*.

GARDEN FRAME.—A figure of the garden frame is given, which is more effectual than any description in showing its construction. The material should be of the best quality of teak, and thoroughly soaked with linseed oil. Its size should not be greater than two men can lift. If two “lights,” *i.e.*, frames containing the glass or windows, are used, 5 feet in length by 4 feet in breadth is a convenient size. The “lights” will then be 4 feet in length and $2\frac{1}{2}$ in breadth, as the greater the area covered the more equable the temperature and humidity; a number of frames may be placed side by side with advantage.



THREE-QUARTER SPAN ROOF FRAME.

Such frames must never be exposed directly to the sun, because the sun's rays can pass inwards through the glass, but are reflected so feebly that they cannot pass out again, and the result is a degree of heat that will destroy rather than propagate plants. The shade of a tree is not a desirable position for a propagating frame, because although its protection may be complete at one season, it is apt to fail as the season changes, and as a temporary mat or other covering is apt to be blown off or neglected some time or other, the garden frame should be under a trellis, which is fixed so as to break the sun's rays but admit light freely.

Ventilation must be carefully attended to; and as cuttings need less ventilation than rooted plants, it is desirable to have more than one frame, so that different degrees of ventilation and heat may be maintained.

Peculiarities of certain Seeds with regard to Germination.

Many seeds are furnished with a hard covering, which prevents moisture from reaching the seeds, and consequently retards germination: for example, the seeds of Babul (*Acacia arabica*), Teak (*Tectona grandis*), and of the varieties of Canna are of this nature. In such cases, the seed may be mixed with cowdung and water and placed in sunshine until the seed has softened and begun to swell. Small seeds, such as Petunia, Begonia, Gloxinea, Mimulus, Tobacco, etc., are apt to be destroyed when germinating by a shower from a rudely handled watering pot. In this case, let the soil have a thorough watering before sowing, and keep the seed-pots in a moist place. By this means the seed will probably be germinated before another watering is required.

Strawberry seed just ripened will germinate partly soon after sowing and partly at long intervals. Cocoa and Tea seeds should be sown as soon as possible after gathering. On the Western Ghats, people wrap Jack Fruit seeds in grass and leave them on the roofs, under heavy rain, until the shoot is about five inches in length. This protects from vermin. In the Konkan, Cocoa-nuts are thrown into a well, where they float, and are protected from ants while germinating.

Seeds which are imported in tins are sometimes specially dried before being packed. Peas treated in this way often need to be soaked in warm water for twelve hours before sowing. When a seed tin is opened, if the paper containing the seeds is damp, the seeds will probably be in an excited condition and will germinate very soon if sown at once. If such excited seeds are exposed to the air and kept a few months, the vital principle will be greatly weakened or entirely lost.

Regarding seeds from temperate climates, in those days of rapid and cheap postal communication it is often advisable to import seed as required for sowing.

The majority of seeds require a period of rest after ripening before being sown for fresh growth, but some germinate freely when just gathered as well as later, and a considerable number will only germinate if quite fresh. It may be of use to note a few seeds of this peculiar habit that occur in gardens.

LIST OF SEEDS WITH EVANESCENT LIFE.

VERNACULAR NAMES.

Achras sapota,	<i>Chicu, Sapodilla.</i>
Ægle Marmelos,	<i>Bael.</i>
Allium sativum,	<i>Onion, Piaz.</i>
A. porrum,	<i>Leek.</i>
Amherstia nobilis,	
Anacardium occidentale, ...	<i>Caju.</i>
Anona squamosa,	<i>Custard apple.</i>
Araucaria species,	
Artocarpus integrifolia, ...	<i>Phunnus.</i>
Azadirachta indica,	<i>Nim.</i>
Bambusa species,	<i>Bambu.</i>
Bassia latifolia,	<i>Mohwa, mohudo.</i>
Camellia theifera,	<i>Tea tree. Cha.</i>
Carissa carandas,	<i>Kuronda.</i>
Cerbera odollam,	<i>Katarali. Dabúr.</i>
Casuarina equisetifolia, ...	<i>Kasurni.</i>
Chrysophyllum cainito, ...	<i>Golden leaf.</i>
Citrus species,	<i>Orange, Lime, Citron,</i> <i>Pommelo.</i>
Clausena wampi,	<i>The Wampi.</i>
Codiæum,	<i>Crotons.</i>
Coffea arabica,	<i>Coffee. Bun.</i>
Cordia Sebestana,	
Diptocarpus turbinatus, ...	<i>Challan.</i>
Durio zebethinus,	<i>Durion.</i>
Eriobotrya japonica,	<i>Loquot.</i>
Feronia elephantana,	<i>Elephant apple. Cowat.</i>
Filicium decipiens,	<i>Pehimba-gaha.</i>
Garcinia indica,	<i>Brindoa. Kokum.</i>

VERNACULAR NAMES.

<i>Garcinia mangostana</i> ,	...	<i>Mangosteen.</i>
<i>Gardenia lucida</i>,	... ..	<i>Dikamalli.</i>
<i>Guatteria longifolia</i>,	... ..	<i>Asaphula.</i>
<i>Hevea braziliensis</i>,	... ..	<i>Para rubber.</i>
<i>H. guinensis</i>,	... ..	<i>Para rubber.</i>
<i>Jambosa alba</i>,	... ..
<i>Jambosa vulgaris</i>,	... ..	<i>Roseapple.</i>
<i>Limonia spectabilis</i>,	... ..
<i>Magnolia Campbelli</i>,	... ..
<i>Mangifera indica</i>,	... ..	<i>Mango.</i>
<i>Melia Azadirachta</i>,	... ..	<i>Bukan.</i>
<i>Mesua ferrea</i>,	... ..	<i>Nag-champa.</i>
<i>Michelia champaca</i>,	... ..	<i>Champa.</i>
<i>Mimusops elengi</i>,	... ..	<i>Bachul.</i>
<i>Murraya Koeniga</i>,	... ..	<i>Cadi-nim.</i>
<i>Myrtus communis</i>,	... ..	<i>Myrtle.</i>
<i>Nelumbium speciosum</i>,	... ..	<i>The Lotus. Kamal.</i>
<i>Nephalium litchi</i>,	... ..	<i>Litchee.</i>
Palms, many species,	... ..
<i>Polyalthia longifolia</i>,	... ..	<i>Asok. Rat. Devadari.</i>
<i>Psidium</i>,	... ..	<i>Guava.</i>
<i>Saraca indica</i>,	... ..	<i>Asok.</i>
<i>Shorea robusta</i>,	... ..	<i>Sal.</i>
<i>Theobroma cacao</i>,	... ..	<i>Cocoa or Chocolate.</i>
<i>Triphasia trifoliata</i>,	... ..	<i>Chin-ke-limbu.</i>

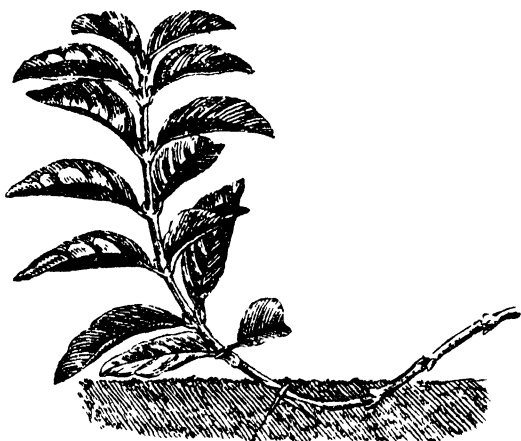
TO PROTECT SEEDS FROM BIRDS.—Mix the seed in a paste made of red-lead (*shendur*), cowdung, and water, so that every seed may get a coating of red-lead. The depredators take one or two only—not enough to kill, but enough to deter.

DEPTH SEEDS SHOULD BE SOWN.—It is a very good rule to cover seeds with soil about equal to the circumference of the seed itself; but it is not advisable to cover any seed with more than four inches of soil.

Care should be taken in watering seeds not to dislodge the soil or the seed, and the seed-bed or pot

should be shaded from direct sunshine but allowed a full share of light, as the tender seedlings grow rapidly and are easily injured by being drawn up weakly when light is deficient.

Seed-beds and pots should be protected from heavy rain, as the surface of the soil becomes caked, so that seedlings have great difficulty in forcing their way through, and the seed is often condemned as bad, from the fault of the cultivator.



LAYERING BY TONGUEING OR HEELING.

It is advisable to mix very small seeds with some fine earth before sowing, to secure equal distribution.

Which side or end of the seed should be uppermost is not of importance in sowing. If the seed be allowed to fall gently on to the earth, the side that Nature intended to touch the soil will assume its proper place.

Seeds of cabbage and cauliflower may be mixed with those of carrot, or *kotmir*, or any other odoriferous herb, so that they may germinate together, and the cabbage or cauliflower be protected.

During June and July, when insects are specially busy, it is advisable to keep some damp litter smouldering to windward of the seed-bed, to deter insects.

PROPAGATION BY LAYERING OR *GUTI*.

This is a simple operation, by which many plants that are difficult to root from "cuttings" may be propagated, a branch being induced to produce roots and ultimately being cut off and treated as a separate plant. If the branch to be *layered* can be bent down to the ground, a slit may be cut parallel with the surface of the soil, beginning on the proximal side of a bud and extending an inch or two towards the free end of the branch. Sand being placed in the slit to prevent re-union, and the part covered with fine soil, a stone may be placed above to keep all steady, and water supplied as the soil dries. It is obvious that where the branch cannot be brought down to the ground, soil may be raised to the branch, either in a pot supported on a stage or, as in the method termed *Guti*, by tying the soil in a mat round the branch, and water may be supplied by suspending a pot above the branch from which water may drip as required. In layering the *Allamanda* and other plants having trailing branches, shallow pots with good soil may be piled one above another, the branches being layered in each, with the upper one reserved to receive water, which will trickle downward and keep the whole moist.

TO PREPARE A HOT-BED.

Select a garden frame and dig a hole in the ground two feet deep and one foot longer and wider than the frame. Prepare sufficient stable litter and dead leaves; mix in equal parts and, if dry, moisten freely; fill the hole gradually, treading evenly and gently as the filling progresses, and let the hot-bed rise about two feet above the surface of the ground. The hole in the ground induces slow fermentation by little air reaching the material. If cowdung only is available, leave on the surface. Fit on the frame, and place in it a layer of sandy soil about four inches in depth. Close the frame, and leave a few days. The fermentation of the hot-bed

will raise too much heat for a short time; when the temperature has fallen to from 10° to 20° higher than the shade temperature outside, it is fit for "cuttings." In such a hot-bed, "cuttings" of soft-wooded plants root freely, and seeds are hastened in germination, the resulting plants being transferred later to a cool frame and gradually inured to open-air conditions. The season of growth is prolonged, and maturity is induced much earlier than if sown in the open ground. In the plains, the hot-bed is useful during the cool season only, but at high altitudes it is useful, as in temperate climates, in forwarding growth in spring.

TILLAGE.

Thorough tillage, or stirring and inverting the soil, has a very important effect on cultivation, and much of the effect of manuring may be produced by stirring the soil thoroughly, and leaving it, in a rough state, exposed to the sun during several months of the hot weather. The effect produced by the sun heat acting on the opened-up soil is practically the same as the beneficial effect of frost in temperate climates—soil particles are torn apart and air gets free passage. Especially is this important in irrigated gardens with heavy soil. Repeated irrigation during several years has a very injurious effect, which liberal manuring will not compensate for. Digging in the Tropics is hard work, and there is a constant tendency to rely on manure and water for fertility, which could be attained by utilizing the plant food already in the soil, and if the digging be carried out during early morning hours, the heat due to direct exposure to the sun may be avoided, and leaving the upturned soil exposed to the air and sunshine has a powerful effect in disintegrating heavy soils. Hurried preparation of the soil immediately before it is required is a waste of the powerful agencies, air and bacteria. The theory of the effects of tillage, as given by Warrington in *The Chemistry of the Farm*, is concise and explicit:—

“By tillage the surface soil is kept in an open, porous condition, favourable for the distribution of roots. By this means, also, capillary attraction is diminished, and the land consequently suffers less from drought: the water-holding power of the surface-soil is also increased. A more important result of tillage is that the soil is thoroughly exposed to the influence of the air. Soils containing humus or clay will absorb ammonia from the atmosphere, and thus increase the store of nitrogen. The organic remains of former crops and manuring are also oxidised, the nitrogen being converted into nitric acid. The rocky fragments which a soil contains, such as fragments of silicates or limestone, will at the same time be more or less disintegrated by the combined action of water and air, assisted by the carbonic and humic acids arising from the oxidation of vegetable matter, and a portion of the insoluble plant-food be thus brought into a state suited for absorption by the roots of crops.”

“The maxim which should direct ourselves should be that which has directed almost all successful scientific investigation since scientific investigation has become one of the principal businesses of mankind. It is, to use hypothesis as a guide to the collection and examination of facts, and not to start on your collection or investigation with any hypothesis so firmly rooted in your mind as to allow it to impair the critical impartiality of the gaze with which you look on the phenomena subject to your examination.”—*Rt. Hon. A. J. Balfour.*

GRAFTING.

GRAFTING implies the adhesion by organic union of a part of one tree to another tree. It is used to increase the number of plants of desirable varieties which cannot



GRAFTING.

be raised from seed, and is possible only between trees very closely related to each other and with similarity of sap and constitution, such as between an inferior and a valuable sort of mango, between the sour lime and the orange, the crab and the apple; and it is *practicable*

only between the members of the class *Dicotyledons*. In the other class of flowering plants, *Monocotyledons*, grafting has been effected rarely, as a scientific curiosity, attainable when the root stock specially abounds in generative tissue, as in the banana, turmeric, and similar plants.

HISTORY OF GRAFTING.

Natural grafting is of frequent occurrence—the roots of the banyan tree, which has germinated high on the stem of another tree, graft and regraft one with another as they descend to the ground; and the branches of ivy and other woody climbers unite with each other as they ascend trees. Probably from observation of these facts, man learned to graft in early times. Theophrastus, who lived in the fourth century before Christ, describes the process, and Pliny, who lost his life from the eruption of Vesuvius, A.D. 79, distinctly states that nuts, berries, grapes, pears, figs, and pomegranates cannot be grown on one plant, and notwithstanding that during the intervening years no one has presented proof to the contrary, there are still a few who believe that plants widely differing in habit may be grafted together. This idea is maintained by a charlatanic trick. Slender stems of several plants are passed through one hollow stem, and the group being planted in a pot, assumes for a short time the appearance of being one plant, although no organic union has taken place, and early death of the weaker members of the group from compression by the more vigorous is ensured.

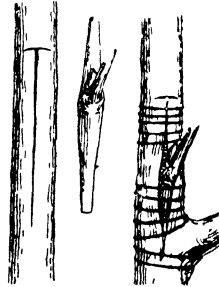
In dicotyledonous trees, while swelling buds and growing young leaves indicate a special movement of the sap, a layer of cells between the wood and the bark, termed *cambium*, is in active growth, and the bark may easily be raised from the wood. This occurs regularly during spring in northern regions, but within the monsoon region, which limits the strict application of these notes, the spring is hot and arid and the favourable season for grafting extends from June to January,

stormy seasons at the opening and the closing of the monsoons being avoided or special shelter provided.

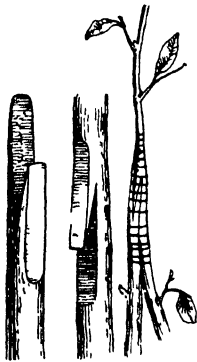
A simple graft, specially recommended to the inexperienced operator, is termed **INARCHING**, or **GRAFTING BY APPROACH**. This is effected by bringing two trees



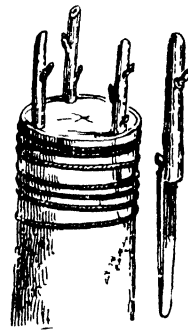
INARCHING.



BUDDING.



CLEFT GRAFTING.



CROWN GRAFTING.

together, of the classes described above, and cutting from both a portion of the bark with enough of the underlying wood to give a plane surface, both wounds being as nearly as possible of the same size—three or four inches is sufficient—the cambium of the two trees, which lies between the inner bark and the wood, is

brought into contact, bandaged together, and covered with tempered clay to keep out air and water. The cambium cells unite to form one tissue, capable to forming all the various sorts of cells of which the tree is composed, and future growth continues as of one tree. This operation may be successfully performed at any season, but requires less time to form a union if done while the trees are in vigorous growth. Six months in contact is sufficient in any case, and two months is usually enough to form a complete union. This operation is practicable only on such plants as have true wood with concentric circles on the cross section, but is not *practicable* on Monocotyledons (palms, grasses, etc.).

When a little skill has been acquired by practice at the simplest form of inarching, a convenient improvement may be introduced. This is the formation of a tongue on each of the cut surfaces to be brought into apposition. One tongue being directed upward and the other downward, and both similar in size and position, the tongues may be interlocked, and the result is a larger area of cambium in contact and a more effective graft. Skill in the formation of this form of graft may be acquired by practice for a short time on twigs cut from common trees.

The graft by approach or inarching is usually performed between a large tree of a superior variety growing in the ground and a small seedling of the same species growing in a pot. The plant in a pot may be elevated to the branch of the large tree by tying it to a thick branch, or a stage may be erected on which a large number of pots may be arranged. The chief difficulty is to see that the plants in pots are *regularly watered*—the soil *must be kept moist*—and from the position of the pots the watering is apt to be neglected, at times, sufficiently to nearly kill the young stock. It is advisable to explain the necessity for careful watering to the man entrusted with the work, and give him a premium on success.

TRUE GRAFTING, as distinguished from Inarching, consists of causing a twig cut from one tree to form a union with another tree of the same species. The essentials are as given above, but a higher degree of skill in the operation and selection of the proper season is necessary, because in this instance one of the two trees only—termed the *stock*—is rooted, and the twig, cut from a distant tree (or *scion*), must be kept alive until cohesion has taken place. The proper season is when buds are swelling and young leaves growing. This occurs several times between June and January, and with the aid of the *graft protector* described below, grafting may be safely essayed during the seven months indicated.

There are many different methods of grafting, but the essential in all is, as indicated, to bring the cambium of two plants into contact. The cambium is between the wood and the bark, and sometimes the bark of different kinds of mango, for example, varies in thickness, hence exact fitting requires intelligent attention. The outer bark may not fit exactly, but the cambium must fit.

The SADDLE GRAFT is desirable when the stock and the scion are equal in thickness. The stem of the stock being cut through about twelve inches from the ground, the top is cut in the form of a wedge about three inches in length, and the scion may be split up the middle with a sharp knife and fitted neatly on the wedge, tied, and a lump of tempered clay pressed round the wound, and a little clay pressed into the open pores at the upper end of the scion if it has been cut. The skilful knifeman will cut out a wedge from the base of the scion exactly similar to that at the end of the stock; this causes a neater union, but is not essential.

The WHIP GRAFT is convenient when the stock is slightly thicker than the scion. The head of the stock is cut off, and a slice taken from one side about four inches in length and in width equal to the diameter of the scion. On the face of this wound a downward

incision is made to form a tongue, and the scion is cut a similar length with an inverted tongue to fit the other, and the parts being placed in contact, are banded and clayed as before. This craft is specially suitable for the jambul tree.

The CROWN GRAFT is desirable when the diameter of the stock is much greater than that of the scion. In this form of grafting, the stock is cut over, about two feet from the ground, with a saw, and the grafting knife being pressed through the bark about six inches from the top, is drawn upward with firm pressure, cutting through the bark. At the top of the cut the bark is then raised gently, and a smooth piece of bone or hardwood is lightly inserted to raise the bark on both sides of the vertical cut. The scion being cut in the form of long wedge, is gently pressed into the recess. A smart operator may put several grafts on one stock by this sort of graft, but it is doubtful whether there is any advantage. Tying firmly with coir string is desirable in this instance, and a thorough coating of clay is necessary.

Grafting on roots is practicable with a large number of plants, and the practice has special advantages. Buds do not start from the stock and give trouble. Tuberous rooted plants, such as the dahlia, are particularly easy to manage in this way. A V-shaped incision made vertically in the root, and the scion cut to fit and bound in its place, covered with wax, and kept close a few days, is sufficient. The clematis, bignonia, hollyhock, dahlia, pomegranate, and guava, are specially adapted for this system.

MATERIAL FOR BANDAGES.—A strip from the stem of the banana (*sopat*), or from the leaf of the *Raphia* palm (*Raphia fibre*), or from any other palms, or the leaf of *Typha latifolia*, bulrush, or *pan-kaness*, may be used as bandage. String should be avoided if possible, as it brings great pressure to bear by contraction on a

limited surface, and causes wounds. Tape or strips of indiarubber may be used for delicate subjects.

BUDDING is a variety of grafting, and it is a very simple yet delicate operation (see page 37). It consists of removing a bud from one plant and making it grow on another plant, which must be of the same family and closely related, although it may yield fruit or flowers of an inferior character. For instance, a bud from an orange may be grafted on a lime tree, and a peach bud on a plum tree, but a rose-tree bud will not succeed on an orange tree. In budding, a single bud is cut from the twig of the plant to be propagated; if there is a leaf attached to the bud, the blade of the leaf may be cut off; then, by inserting the knife about half an inch above the bud and cutting slightly inwards and downwards, bring the knife out about half an inch below the bud. This removes the bud with a small shield of bark attached, and generally a little bit of wood adhering to the centre of the shield. This bit of wood may be removed with the point of the knife. Its removal is not essential, but as it increases the uniting surface, it is desirable. A longitudinal slit, a little longer than the shield of the bark, should then be cut in the bark of the tree to be worked on, and at the upper end of this slit a small transverse cut made to facilitate the raising of the bark, so that the cut is T-shaped. In making this cut, care must be taken not to go deeper than the bark. If the wood is cut into, an obstruction is formed, which causes injury; this point is of special importance in budding the orange tree. Then taking hold of the cut corner of the bark with the point of the knife, raise the bark slightly, and inserting the handle of the knife between the bark and the wood, raise the bark on both sides sufficiently to allow the bud and its little shield of bark to be slipped in; then close over the cut edges of the bark and tie with tape or worsted thread, or

perhaps, better still—because not liable to contract or expand by change of weather—with the *sophat* or strip of fibres obtained from the stem of a plantain tree, or with *raphia*, the fibre from a palm leaf. The proper season for budding is at any time when both the tree which yields the bud (the scion) and the tree which receives it (the stock) are growing freely.

By regular practitioners, a peculiar form of knife is used for budding. It has a blade which is sharpened at the point from the edge to the back of the blade, so as to cut with the end of the blade when making the slits in the bark of the stock, and a handle of bone or ivory, very thin at the end, to raise the bark with. If such a knife is not at hand, a sharp penknife and a small paper-cutter make good substitutes (see No. 39 in illustration of garden tools).

In budding the orange on to the citron stock, it is not necessary or advisable to make the cross-slit. By bending the stock slightly towards the cut, the edges of the vertical cut may be raised and the bud slipped into its place with very little trouble, while the plant is growing freely.

In budding the mango, a shield of bark about one and a half by one inch is removed from the stock, and immediately replaced by one of similar size from the scion, tied carefully, and the cuts dressed with grafting wax. The season is when the young leaves are changing from the red to the green colour.

GRAFTING CLAY, or St. Faicre Ointment.—A mixture of two parts fine soil with one part bullock dung, with a little water, kneaded together, is excellent for grafts and all sorts of wounds on trees in a dry climate.

GRAFTING WAX, prepared from equal parts by weight of rosin, beeswax, lard, and turpentine melted together over a slow fire, with careful stirring to avoid the mixture taking fire, and applied warm—such as the

hand can bear—is desirable for small grafts under cover or with heavy rainfall.

3 parts yellow soap, $10\frac{1}{2}$ pine rosin, $1\frac{1}{2}$ tallow, 1 turpentine. Melt, mix, pour into moulds, and roll out.

GRAFT PROTECTOR.—All grafts in the open must be carefully protected from sunshine, and if the air be dry, a graft protector should be employed to cover the graft and maintain moist air in the vicinity. A large flower pot inverted over the graft and shaded carefully with grass, over which water may be sprinkled when dry, makes an efficient protector, but substitutes may be found to give the essential shade and moist air.

“ I took his brush and blotted out the bird,
And made instead a gardener putting in a graft,
With this for motto—‘ Rather use than fame.’ ”

—*Merlin.*



IRRIGATION AND WATERING.

How much water is required for gardens is so much a question of character of soil and climate that, without local details, it is difficult to answer, but the following notes, if applied intelligently, may be taken as a safe guide. Fifty tons of water per acre weekly—that is, half an inch in depth over the surface of an acre—is a fair allowance for a loamy soil with mixed garden crops in the dry climate of the Dekkan. In like circumstances, a crop of lucerne will take seventy tons, and sugarcane and bananas a hundred tons per acre weekly, in addition to a rainfall of thirty inches yearly.

Young plants, and such as have been recently transplanted, require a thorough watering to settle the soil about the roots, and thereafter a small quantity every evening until established; then the dose and the intervals may be greatly increased. A liberal supply sinks into the soil and less of it is lost by evaporation, while the roots are encouraged to grow downwards, whereas a small supply at short intervals keeps the roots near the surface, subject to frequent change of moisture and temperature.

Plants in pots should be watered with due regard to the comparative size of the plant and the pot. If the plant be large and the pot full of roots, daily watering may be necessary to the depth of half an inch or less if in a conservatory, but if exposed to the sun the quantity daily required may be much greater, but pots are quite out of place in such a position. Club mosses and some ferns enjoy sprinkling with water twice daily.

A lawn or flower bed of shallow-rooted plants will take two large watering pots, or four gallons, of water daily per hundred square feet—that is, equal to 54 tons 9 cwts. of water weekly.

One inch of rain is equal to 4'673 gallons per square yard, or, roughly, a half-gallon per square foot.

In every garden where practicable, the water should be supplied from a tank at least twenty feet above the level of the garden, and conveyed throughout by iron pipes under the paths, with frequent taps for drawing supplies through a hose pipe. This is costly at first, but is a constant source of saving in wages that is highly profitable. The loss from imperfect channels leaking, and setting plants growing when they should be resting, is an important item.

In canal irrigation, a stream five feet wide and three feet deep in the centre moves sufficiently with a fall of ten inches in the mile; a greater fall would cut up the bed if formed of earth. A stream one foot in width and six inches in depth at the centre requires a fall of two to three feet per mile to move with sufficient celerity.

Rule for calculating the irrigating power of a stream: Set up a weir of thin iron, with a rectangular notch in it estimated sufficient to let the water pass with a moderate fall. Insert a stake in the canal sufficiently above the weir for curvature of the water to be avoided—two to three feet is sufficient in small canals. Level from the head of the stake to the weir; then multiply the depth of water on the stake by its square root and by the length of the weir in inches and by 2.67. The result is gallons per minute.

The duty of irrigation water is taken to be 150 acres per cubic foot per second by the Indian irrigation authorities.

6,272,640 square inches = 1 acre.

227 cubic inches - - = 1 gallon.

In watering flower beds and isolated plants in garden borders, where it is not convenient to irrigate in the ordinary manner, a great saving may be effected by burying unglazed, narrow-mouthed, earthenware pots deep enough to cover the pots, and occasionally filling them with water. Such pots need only be used during the growing season, and must not be kept constantly

full, but whatever water is applied will be utilized to advantage. The French use large bottles filled with water, inverted, and the neck pressed into the soil. This method has the advantage that the supply of water is proportionate to the heat of the sun, and may be regulated nicely—the rate at which air bubbles ascend is the measure of water descending. Fine sand is desirable at the mouth of the bottle; clay is apt to stop the water. Hollow bamboos may be driven into the soil and occasionally filled with water, but soil should not be kept constantly wet. If there be no alternation of wet and dry, air does not get into the soil, and a loss of fertility results.

In watering rose trees there is scope for much skill and discretion, and nothing is more injurious than mechanical dosing with water at stated intervals, and the result of leaving such work to the *bheastie* or to the least experienced assistant in the garden is deplorable. The object to be aimed at should be to saturate the soil one day, leave it to dry until it is evident that further dessication will cause wilting, then saturate once more

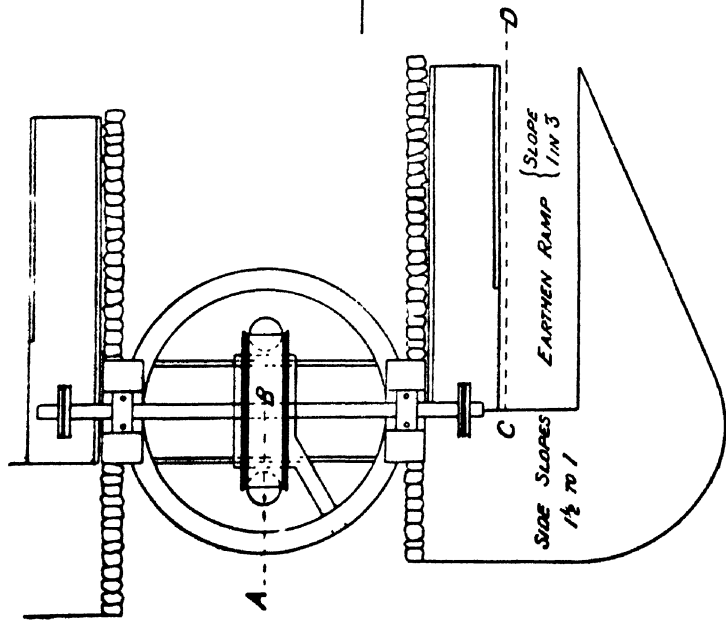
MACHINES FOR DRAWING WATER.

THE MOTE.—When irrigation is done by drawing water from a well more than twenty feet deep, a leather bucket with a wide pipe from the bottom, called a “mote,” is generally used. The “mote” is made of hides sewn together in the form of a circle about six feet diameter. When the edges are fastened up to the iron ring which forms the mouth, and the end of the pipe from the bottom is held up, it makes a bag capable of holding forty gallons of water. This is drawn up by a pair of stout bullocks going down a steep ramp (in the Dekkan two pairs of ordinary bullocks are commonly used), and the pipe from the bottom of the bag being conveyed over a pulley a few feet lower than the mouth of the bag rises, forms a simple yet effective arrangement for drawing the water. When the depth of the

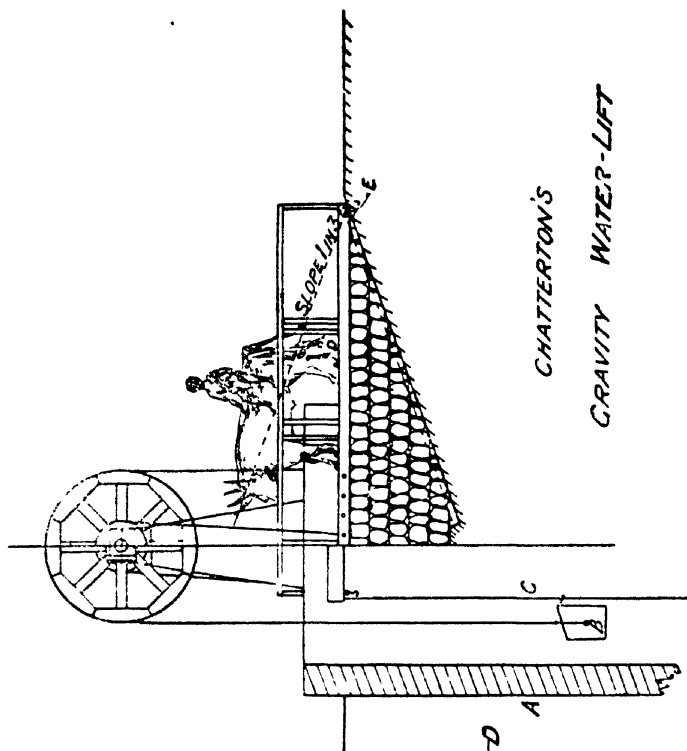
well is about twenty-five feet, an ordinary pair of oxen will raise the "mote" forty-five times an hour. Occasionally a very deep well is met with, where the bullocks are unhitched at the bottom of the ramp and turned to walk up to the well-mouth again by a longer road but not so steeply inclined; but generally the cattle are required to back up the steep slope, and the apparent distress caused has moved many to invent a more humane process; but more complicated apparatus is costly in erection and maintenance, and improved systems are rarely adopted.

THE NARIAD WATER-LIFT, or DOUBLE MOTE, is a contrivance by which two buckets are kept in motion by one bullock or by a pair tandem. One bucket ascends while another descends, so that one balances the other, and the weight of water, only, has to be lifted. In this arrangement the bullocks, yoked tandem, walk in a circle continuously in one direction, turning a large drum on which the bucket ropes are wound and unwound. A simple reversing gear, causing the drum to turn now in one direction, now in another, is worked by a lever at the hand of the driver. With the double mote, 1,500 gallons of water have been raised twenty feet at a cost of one anna.

THE PYCOTTAH.—The instrument known as the *dhenkli* in the Dekkan, the *pycottah* at Madras, and as the *shaduf* in Egypt, is very convenient for raising water about five feet. It is simply a pole, having a weight at one end and the other suspended over the water. To this end a bucket is attached by a stiff rod, with which the operator brings down the bucket, plunges it into the water, then, with a smart jerk, raises it to the level of a trough fitted to convey the water to the field. One man can lift in this way fifteen tons of water, per day of ten hours, a height of five feet—sufficient to water thoroughly one quarter of an acre. Large forms of the Pycottah have the see-saw lever arranged so that two men may walk on it from one



PLAN



SECTION A B C D.

end to the other, and by their weight depress one end while the other raises water. As this utilises the full weight of the men who operate the machine, it is mechanically efficient, but little more can be said in its favour, and improvement is suggested by Mr. A. Chatterton, B.Sc., in Bulletin No. 35, Department of Land Records and Agriculture, Madras.

Mr. Chatterton's machine is a double mote, worked by the weight of the cattle and the driver, and giving the highest possible value for the force employed. Only friction and the weight of the water have to be overcome, and the cattle have no yokes to bear or ropes to draw. The plan and section illustrate its action.

In the section, A is the wall of the well; B is one of the buckets ascending, in contact with its guide-rope, C. In working, the cattle enter on the platform, D, at the hinge, E, the bucket being at the bottom of the well. The platform is sloped upwards one in three, and the bullocks walk up to the end of the platform; their weight causes it to descend slowly, the bucket rising meanwhile, reaching its highest point when the platform has sunk to the lowest point. As the bucket empties, the cattle step off the platform, the bucket descends to the bottom, and the cattle ascend the ramp and regain their place on the platform and repeat the operation. The cattle only carry their own weight up the slope of one in three, with intervals of rest; they always go head foremost, and their powerful hind-quarters make the work easy.

PERSIAN WHEEL or RHAT.—When the water has to be lifted less than twenty feet, the Persian wheel will be found very convenient. It has the advantage that it can be worked by a man. The cost of raising water fifteen feet with this machine, by manual labour, is about the same per gallon as raising it twenty-five feet by the mote with bullock power.

IMPROVED WATER-LIFT or NORIA is an improved form of the Persian wheel or *rhat*. It is prepared in

several sizes: that which lifts 1,500 gallons per hour costs, in England, £15.

PREPARATION OF THE GROUND FOR IRRIGATION.—For vegetable crops it is much better to cause the water to flow over the ground in channels than to carry the water in pots. The ground should be laid out in beds by ridges running at right angles to each other. Two parallel ridges, drawn a foot apart, form a water channel, and if the ground is nearly level, one such channel is sufficient for two lines of beds; if sloping much, a water channel is required for each line. Six feet by nine feet is a good size for beds, but if the flow of water is strong, they may be made much larger.

“Nor is the pleasure which he (the mere botanist) experiences in investigating the structure of a plant, less pure than that which is derived from perusing the noblest products of human genius.”

—*Southey.*



DRAINAGE.

THIS term implies the removal of superfluous water from the soil, one of the first essentials in the cultivation of the great majority of garden plants. The effects of drainage that are specially important are the passage of water from the surface to the lower strata of the soil, assisting the passage of air, and promoting the decomposition of organic matter in the soil and the consequent solution of some of the mineral portions of the soil which is necessary for plants.

Soil which has the interstices between its particles filled with water in a slowly moving state—that is, a marsh—is necessary for comparatively few plants, and their cultivation is treated separately.

When a garden is irrigated from a well near at hand, it is probable that no special attention to drainage may be necessary: the water finding its level in the well may be actually a most efficient form of drainage, sufficient to account for the supposed superiority of well water compared with canal water, which obtains in some parts of the country. When canal water is used, and the lower strata of the soil are not open, some artificial system must be adopted. Drain pipes, such as are used in field culture in Europe, have been tried with only temporary effect; the roots of trees appear to rejoice in the new opening, and quickly fill it up with a perfect mat-work of fibres. Open drains four feet deep are thoroughly effectual, but occupy too much land, and there is a danger of the surface water finding its way directly into them, and *defeating the primary reason for draining*, which is *not so much to dry the land as to cause the water to pass through it*. The most practicable system is to open trenches four feet in depth, grade the bottom with a slope of five inches per hundred yards, and place half-circular roofing tiles, or other open material, in the lower six inches,

cover with sods or garden sweepings, and fill up with earth. Such drains, although absolutely necessary at the formation of the garden, may be found quite dry a few years later, the roots of trees having taken up the work of drainage as soon as the soil was fit for trees to live on.

PLANT LABELS.

SLIPS of deal wood with a thin coating of white paint written on with a pencil are greatly used as labels, in temperate climates where termites do not occur. When necessary to use such labels, they may be soaked in kerosene oil, or in solution of corrosive sublimate.

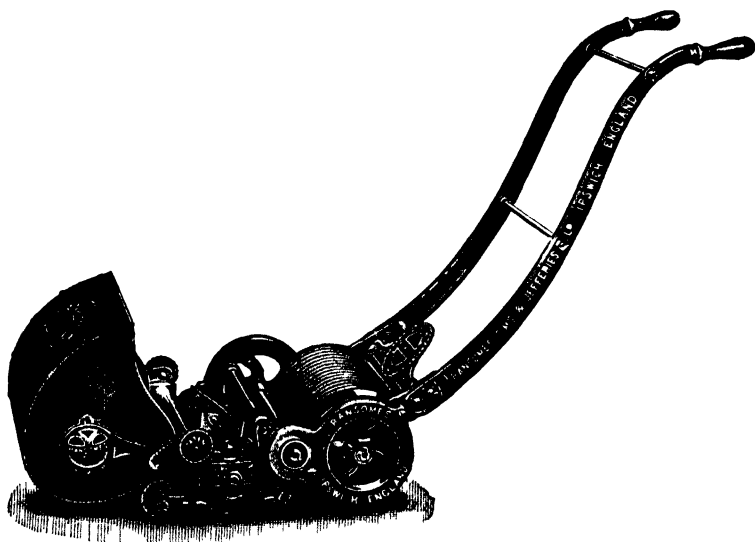
Slips of zinc may be cleaned and written on with perchloride of platinum diluted with water, or with the ink for garden labels given below. Slips of lead, zinc, aluminium, or copper, may have the name impressed with steel letter stamps, and the letters filled with white paint, by covering the whole with paint, and wiping off with a rag drawn in one way only.

AN INK FOR GARDEN LABELS may be prepared at a small cost, as follows:—In an earthenware mortar mix one ounce of verdigris, the same quantity of sal ammoniac, half an ounce of good lamp black, and half a pint of water. Shake thoroughly always before using, and in mixing be careful to use a wooden spatula. This will show up very bright on the zinc labels.

“There had been a mysterious sickness among the cattle on the Cloverley Estate, near Market Drayton. A number of valuable polled Angus cattle were found to be ill. Four beasts were found dead. A veterinary surgeon made a *post-mortem* examination, and discovered that they had eaten a quantity of poisonous yew and laurel leaves, which had caused their deaths.”

GARDENING TOOLS AND IMPLEMENTS.

IN our illustration of gardening tools, the sequence of the numbers is not exactly such as would be naturally adopted, still, it is desirable to retain the arrangement given in the picture. Therefore to be noticed first is—



MOWING MACHINE

No. 1.—*The Roller used for making paths and lawns firm and smooth.*—Frequent rolling on the lawn has a tendency to produce short dense growths of grass, and renders paths comfortable to walk upon.

No. 2.—*Mowing Machines for cutting short grass.*—This implement needs care to keep it well oiled and all bolts at a proper degree of tightness. The setting of the revolving cutter upon the fixed one so as to leave the least possible free space, should be attended to. Some mowers are arranged to permit the revolving cutter to be reversed, so that as one side of the cutting blade

becomes dull, the cutter may be reversed and thereby sharpen itself. To sharpen a lawn mower, a handle is provided, which fits into one of the wheels and allows the cutter to be revolved rapidly without making progress, whilst a file held against the cutters grinds the edges. It is advisable to get this work done by a mechanic. Let the mower be carefully cleaned, dried, and oiled at the end of every day's work.

No. 3.—*Plough*.—Every garden of considerable size should have a small plough, because ploughing is much cheaper than digging.

No. 4.—*Watering Pots*—should be provided of three sizes, to suit different kinds of work and the varied capacity of the workers. For garden work, no watering pot should be larger than three-gallon capacity. Sets of two-gallon and one-gallon capacity should also be provided. Tinned or zinc-coated sheet-iron is generally used. The “rose” or water-spreader should be of brass, and with the perforated face removable by a screw.

No. 5.—*Hoe (Powra)*.—The hoe is a very important implement in tropical gardens, because a great deal of soil-stirring, weed-cutting, and irrigation water-tending is done with it.

No. 6.—*Dutch Hoe* - is used for cutting down weeds between rows of plants or on footpaths. In using it, the worker moves backward, resting the blade on the ground, and pushing so as to cut down weeds.

No. 7.—*The Swan-neck Weeding Hoe*, and No. 8.—*The Common Weeding Hoe*—are used for cutting down weeds.

No. 9.—*The Rake*—is used for smoothing the surface of seed-beds and footpaths.

No. 10.—*The Daisy Rake*—is designed to cut the flowers off dwarf-growing weeds, and prevent seed from forming.

No. 11.—*Pruning Shears for clipping edgings*.



TOOL HOUSE IN A TROPICAL GARDEN.

No. 12.—*Pruning Shears* of this form will cut a considerable branch. In using all such implements, *the blades should be at right angles to the branch to be cut.*

No. 13.—In this form of *Pruning Shears* one blade slides, so as to give a drawing cut, and makes a cleaner wound than the other.

No. 14.—*Pruning Saw*—is designed for cutting green wood. Its blade is thicker than an ordinary saw, and the teeth have a set adapted for this work.

No. 15.—*A Wrench*—is one of the accessories of a mowing machine.

No. 16.—*Flower-gathering Scissors*—which enable one to cut and bring away the flower with one hand.

No. 17.—*The Sickle*.—The instrument depicted is of a small size, of good design.

No. 18.—*The Spade*.—A miniature form suitable for stirring the earth between plants in flower-beds.

No. 19.—*The Holburn Pump*.—Useful for squirting water over plants to remove dust or insects.

No. 20.—*The Cross-cut Saw*.—For cutting logs of timber transversely.

No. 21.—A miniature *Planting Fork*, useful for work in flower beds.

No. 22.—*The Syringe*.—A squirt for throwing water on plants to clean them and to moisten the air.

No. 23.—*The Asparagus Knife*.—Used for cutting the shoots of that vegetable under the surface of the ground.

No. 24.—*The Kurpi* or *Weeding Hook*.—A useful instrument in re-potting for stirring the hardened soil.

No. 25.—*Transplanting Trowel*.—A trowel with a curved blade used in transplanting small plants.

No. 26.—*Scythe*.—An effectual tool for cutting long grass or corn. Its edge is kept very keen by the use of—

No. 27.—*The Scythe Stone*—which is drawn lightly along the edge of the scythe by short, rapid strokes directed towards the point.

No. 28.—*Edging Cutters*.—Grass adjoining the foot-path will at times encroach and make an untidy margin. This tool is used to cut the edge neatly.

No. 29.—*Shovel*.—A light but strong specimen of a useful instrument.

No. 30.—*Digging Fork*.—If skilfully used on stiff soil, it is excellent for tilling the ground. In digging, the workmen should first open a clean trench, one foot deep and six inches wide, at one end of the plot to be dug. The soil may be carried to the place where the digging is to be finished if great neatness is desirable. When the first trench is completed, the digger begins at the left-hand side, with his face to the trench. At a distance of four to five inches from the trench, by the right foot placed on the right shoulder of the spade and the weight of the body on the handle, the tool is pressed into the earth until the foot touches the surface. By a firm backward pressure of the left hand on the handle, the earth is brought forward, and the right hand at the same moment slipping downwards seizes the handle near the base. The earth is raised and *completely inverted* on the opposite side of the trench. The process is repeated until the line is finished, then the digger continues in the inverse direction. Digging is hard manual labour, but the most thorough of all systems of tillage.

No. 31.—*Pruning Saw*—has a thin blade strengthened by a bow and tightened with a screw.

No. 32.—*Axes*.—Two sizes are necessary in a garden. Western axes are usually made of cast steel, and must be sharpened by grinding. Eastern axes are made of forged

steel, and are sharpened by the blacksmith heating the axe, beating its edge fine, and then grinding it.

No. 33.—*Seed Box*.—A tin box to preserve seed from rats and damp.

No. 34.—*Herbarium*.—The gardener can not remember the names of all the plants he has to deal with, yet it is necessary for him to be able to find the name easily. For this purpose, a complete set of specimens of all the cultivated plants and weeds which spring up in the garden should be dried by pressure between absorbent paper, and when thoroughly dried, duplicate sets should be prepared, numbered alike, and glued to stout paper. The specimens should be complete with root, stem, leaves, flowers, and fruit, if possible; at least leafy branches from different parts of the tree, with flowers and fruit, are necessary. A convenient size of paper is 16 × 10 inches. For a small local herbarium, it is advisable to have the sheets arranged in books with stout covers. Varieties which differ only in the colour of the flower, or such unimportant character, are not distinguishable by dried specimens. One set of the specimens may be sent to the nearest botanical garden for identification.

No. 35.—*Verging Shears*.—For clipping the grass which overhangs the edge of a grass border at the side of a footpath.

No. 36.—*Diary*.—This book is important to the gardener. It should be a perpetual diary, each day having considerable space. As the diary is intended to last many years, the binding and paper should be strong. In the diary, the gardener will note that on such a day he sowed certain seeds, transplanted particular trees, and grafted, formed, or dressed a portion of his charge. The state of the weather at the time may also be noted, and the result of the operation entered. Plants noticed in flower for the first time during the year, and other incidents which may appear of little importance at the

time, should be noted, as they often become of value later.

No. 37.—*Pruning Shears* or *Secateur*.—A convenient tool for use with one hand. A thick branch can be lopped off with this instrument.

No. 38.—*The Pruning Knife*, or *Grafting Knife*, is strong and of the best steel: the handle is slightly curved to improve the grip, and the blade is straight. The best of all pruning work is done with such an instrument. The wounds it makes being clean and smooth, heal rapidly, and make a very small scar. A keen edge must be kept on this knife. A “hone” is necessary for it.

No. 39.—*The Budding Knife*—is a delicate instrument. The blade is of the finest steel, ground to a fine edge on the point, so that it may cut the bark of a plant while held vertically. Its handle is reduced to an edge at the end, in order to assist in raising the bark in the operation of budding.

No. 40.—*A Turf Beater*.

No. 41.—*Iron Basket* or “*Gumela*.”—Is useful for carrying soil and manure.

No. 42.—*Mallet*.—Some soils are so stiff that nothing short of a mallet will break them down after being dried by the sun. The mallet may be of babul wood, and the edges should be rounded to prevent fraying.

No. 43.—*Crowbar*.—In fixing fences and other kinds of work, the crowbar is indispensable.

No. 44.—*Oil-can*.—An oil-can with machine oil is necessary where a mowing machine is used.

No. 45.—*A Measuring Chain* for land, and a tape for small measurements is also desired.

No. 46.—*Augur*, 1 inch, for boring holes in tubs.

No. 47.—*Steelyard for Weighing Heavy Goods*.—If weighing is not of daily necessity, this is a convenient instrument. For small quantities of seed ordinary scales and weights are desirable.

No. 48.—*Water Bucket*—is in use in the garden several hours daily, and extra weight of metal in the bucket adds greatly to the labour in using it, without any advantage. For watering, in many circumstances, this is better than a watering pot. An ordinary workman uses a light pair, carrying 60 lbs. of water, with ease.

No. 49.—*Pick*.—This is the chief instrument for stirring the soil in many tropical gardens. It should be entirely of good steel, and if one end is sharpened and tempered like an axe, it is useful for cutting roots of trees that may be met with while digging. It is then a *Grubbing Axe*.

No. 50.—*Sieves*, of 2-in., 1-in., $\frac{1}{2}$ -in., and $\frac{1}{4}$ -in. mesh, are desirable.

A *Lantern* and a *Garden Line*, a stout cord mounted on a convenient reel, are in daily use.

A *Cabinet with Drawers* is very convenient for keeping small tools.

Seed Jars or *Tins* are necessary.

A *Hand-cart* or *Wheelbarrow*, with two wheels, is desirable for moving plants, soil, and manure. A *Plumb* or *Spirit Level* is required for laying out paths and water channels.

“Gardening is the purest of human pleasures, and the greatest refreshment to the spirit of men.”—*Bacon*.

PRUNING.

PRUNING is the art of removing certain portions of plants with a view to the production of superior fruit and flowers or of improved symmetry. It consists of two distinct operations. Firstly, the removal at the end of the growing season of branches which have reached a considerable size or may be weakly or decayed. The degree to which branches may be cut out with advantage varies greatly with the habit of the plant operated upon and on the climate in which it is grown, and special notes on pruning are given when referring to particular plants; here, only general principles are referred to. In plants cultivated in a climate cooler and more moist than naturally is suitable—as, for example, the vine and some varieties of the rose in Britain—only the buds at the base of the growth of one year are sufficiently developed to produce strong flowering shoots in the following year; therefore, the long branches are cut back, and the full stored-up resources of the plant are concentrated on a few vigorous buds, which will duly develop flowers and fruit, instead of on numerous buds which would produce weakly shoots, unable to bear flowers but furnished with superabundant leaves, which would prevent sufficient exposure to sunlight to ripen the fruit perfectly. But shoots of the same kind, in a warm, dry climate, may be retained a considerable length owing to a larger number of the buds being fully developed. The same fact may be further illustrated by the potato. All over its surface buds appear at intervals, but more thickly and more prominent at the end which was nearest to the parent plant—the rose end; this was earlier produced, and experience proves those buds to develop more vigorous growth than the buds elsewhere developed.

The removal of branches, as indicated above, is generally performed while the tree is at rest after the growth of the season has been completed. If done at the beginning of the growing season, before many leaves are developed, the sap may escape from the unhealed wound. This occurs in a special degree in the vine and banana, which pour out much sap if cut at the beginning of the growing season, and are weakened proportionately. This is technically called "bleeding."

The second operation cutting out the points of growing shoots—may be performed when the plant is in full growth. This is suitable for keeping herbaceous or soft-wooded plants symmetrical and for diverting the current of sap into fruit during the early stages of growth after the flower has been properly fertilised and the fruit has fairly started to grow.

Sharp tools are necessary in pruning, because the wound made by a sharp tool heals more quickly than a ragged wound will do. If it be practicable to cut a branch with a pruning knife, the result is better than any kind of shears produces, because shears are rarely in the perfectly sharp condition necessary for making a wound without bruising the tissues. A saw with an extra thick blade, or a thin blade strengthened by a frame, is suitable, but the wound made by a saw should be dressed at the edges with a pruning knife, and all freshly pruned surfaces should be coated with some substance to prevent the entrance of air, carrying with it bacteria which set up changes in the tissues, illustrated in the gum which issues from rough wounds in *babul* trees and other forms of *Acacia*. Pitch, tar, or paraffin wax are most suitable for this work; but in dry climates, St. Faicre Ointment—a mixture of cowdung and soil worked into a paste with water—is efficient.

"To me the meanest flower that blows can give
Thoughts that do often lie too deep for tears."

—Wordsworth.

TRANSPLANTING.

FOR successful transplanting, the essential conditions are that the exhalation of moisture from the leaves be kept as low as possible while the roots are unfit to absorb a full supply of moisture; for this reason, if trees are deciduous, they may be transplanted with most safety while the leaves are falling. Exhalation of moisture from the leaves of plants goes on most rapidly when the atmosphere is dry and the sky cloudless; therefore, for plants in foliage, if the transplantation cannot be done in moist cloudy weather, these conditions may be secured by shade, and frequent sprinkling with water. If possible, all plants should be transplanted with a mass of soil about the roots, which should be disturbed as little as possible; but some plants which have large woody roots and few fibrous roots near the stem, such as rose trees that have been growing for a number of years in the same place, it is of little use lifting a ball of soil with the plant; it should be dug out carefully, keeping the roots as entire as possible, carried to its new site, where the hole should have been prepared at least twice as large as the roots require. When the tree is placed in the hole, it is of importance that the roots be kept in their natural positions. If any roots have been broken, they should be cut off with a sharp knife, and the soil packed carefully, so that all the interstices may be filled. As the filling up progresses, the soil should be trodden thoroughly at short intervals, so as to make it very firm throughout the whole mass. The author has transplanted many large trees successfully, and considers the last point of special importance and requiring unremitting attention. When such repeated treading is necessary, it is obvious that wet soil is not suited for the purpose; sand may be freely used if the soil be wet. Manure should never be placed immediately on the roots of a plant; some fine soil should

be placed on the roots first, then manure may be put in and covered with soil. Before transplanting trees, it is advisable to prune away a number of the smaller branches, and especially any unripe shoots, which would probably die in any case. By this means the stomata through which exhalation goes on, are diminished, and the plant gives up less of its moisture.

The newly transplanted tree must be supported against swaying by the wind, otherwise it cannot strike root: the method of doing this will readily suggest itself in each individual case; for large trees three ropes or wires fastened to strong pegs driven into the ground like tent ropes may be necessary, but for anything under six feet in height, the stems of *Veda-ouse*, a large sugar cane-like grass (*Saccharum procerum*), planted on three sides at a distance of two feet from the newly planted tree, and joined to it near the top by plantain fibre bands, are most effectual, and they may be pulled up as soon as the tree has taken root. A list of trees which may be transplanted safely when of large size is given.

SEASON FOR TRANSPLANTING LARGE TREES. — November December are favourable months. The rainy season is not recommended for this work, because it is scarcely practicable to keep lately transplanted large trees steady during that season. The hot season also has gales and is otherwise objectionable. If the tree to be transplanted is tap-rooted, a circular trench, wide enough for the men to work in, must be dug at a distance of two feet from the stem at the surface, and gradually approaching the centre as it descends, until the "ball" of earth is the shape of an inverted cone. To the sides of the ball of earth, split bamboos should be closely arranged and fastened by ropes twisted so as to become very tight.

A TREE-LIFTER must be at hand, consisting of a pair of strong wheels and axle, and two strong poles six inches in diameter at the thicker end, and twenty feet long. About four feet from the thick ends, these poles

should be fastened to the axle, the small ends being tied together firmly. The lifter is then backed up to the tree, the short ends of the poles fastened to the sides of the ball of earth, the long end depressed, and the tree lifted. The hole is then filled up with earth, and the tree being placed on the filled in earth, a fresh grip lower down is taken, so that the tree may be run free from the ground. If the distance the tree has to be carried is short, it may be kept erect; but if the distance is considerable, and telegraph wires or bridges are to be passed, it is better to let the tree fall gently across the axle, care being taken that sacking or some other protection is given to the bark.

Trees with spreading roots, such as the *Gul Mohr* (*Poinciana regia*), and *Millingtonia* cannot be lifted with a ball of earth on the root. It is better to begin digging round such trees at a distance of four feet, and cut clean off all roots that pass that line, remove all the soil, and lift as described above. Drag root first, men being stationed to keep the head from rubbing on the ground. To fill in round the root use sand or moist- *not wet* – soil, and pack it among the roots firmly and carefully. Manuring at this stage is not advisable; water thoroughly at once and keep the soil moist for some months afterwards. Fasten the trees firmly by ropes to prevent swaying by the wind.

LIST OF TREES WHICH MAY BE TRANSPLANTED SAFELY WHEN OF LARGE SIZE.

Acacia arabica,	<i>Babu.</i>
Albizzia procera,	<i>Kinye.</i>
Albizzia lebbek,	<i>Sirus.</i>
Azadirachta indica,	<i>Nim.</i>
Bumbusa, several species, ..	<i>Bambu.</i>
Bauhinia variegata,	<i>Kenchen.</i>
Bombax malabarica,	<i>Kanta sciri.</i>
Casuarina equisetifolia, ...	<i>Casurni.</i>
Citrus, several species,	<i>Orange tribe.</i>

Cupressus, „ „	... ..	<i>Siru.</i>
Cycas revoluta,	... ..	<i>Sago tree.</i>
Dalbergia sissoo,	... ..	<i>Sissu.</i>
Erythrina indica,	... ..	<i>Pangara.</i>
Ficus religiosa,	... ..	<i>Pepal. Bo.</i>
Ficus benghalensis,	... ..	<i>Wad.</i>
Gmelina arborea,	... ..	<i>Shewan.</i>
Mangifera indica,	... ..	<i>Amba.</i>
Millingtonia hortensis,	... ..	<i>Coula nim.</i>
Morus indica,	... ..	<i>Tut.</i>
Olea cuspidata,	... ..	<i>Atta jam.</i>
Olea sativa,	... ..	<i>Olive.</i>
Palms, many species.		
Plumeria acuminata,	... ..	<i>Sone champa, Gul achin.</i>
Poinciana regia,	... ..	<i>Gul mohr.</i>

No doubt this list could be greatly extended, but the author has preferred writing only such as he distinctly calls to mind.

COST OF TRANSPLANTING LARGE TREES.—Whether transplanting large trees is profitable or not depends on the time within which the desired effect is wanted. It certainly is costly at first. A tree thirty feet high and weighing a ton cannot be transplanted a distance of a mile for less than Rs. 20. Whether this is more than the cost of planting a young tree and attending to it for several years is doubtful, and local conditions must decide whether large or small trees are selected for transplanting. If care and anxiety are to be avoided, small trees certainly should be preferred, more especially when the planting is done for economic purposes.

Cypress trees which have been raised from cuttings and transplanted several times while young, have usually wiry roots, and may be safely transplanted with a “ball” of earth at the root. Trees of this kind, thirty feet in height, are well worth transplanting. With ordinary skill there is little danger of loss, and the immediate effect produced is valuable.

Palm trees of certain genera, such as the date tree and the cocoanut tree, and others which show a disposition to produce roots from the stem, may have a large box built round the stem six inches from the ground, filled with very rich soil and watered regularly. When the box is full of roots, the stem may be cut beneath the box and the palm carried away safely.

Table for Planters, showing the Number of Trees required per Acre.

DISTANCE APART.	NUMBER PER ACRE.	DISTANCE APART.	NUMBER PER ACRE.	DISTANCE APART.	NUMBER PER ACRE.
1 foot.	43,560	8½ feet.	603	16 feet.	170
1½ feet.	19,360	9 „	537	16½ „	164
2 „	10,890	9½ „	482	17 „	150
2½ „	6,970	10 „	435	17½ „	142
3 „	4,840	10½ „	395	18 „	134
3½ „	3,556	11 „	360	18½ „	127
4 „	2,722	11½ „	329	19 „	120
4½ „	2,151	12 „	302	19½ „	114
5 „	1,742	12½ „	270	20 „	108
5½ „	1,440	13 „	257	22 „	90
6 „	1,210	13½ „	239	24 „	75
6½ „	1,031	14 „	222	26 „	64
7 „	889	14½ „	207	28 „	55
7½ „	774	15 „	193	30 „	48
8 „	680	15½ „	181		

For numbers not given in the above table, take the square of the distance apart the trees are required to stand, in feet, into 43,560; the result is the number of plants required per acre.

PLANT POTS.

A PLANT POT should be in shape a section of a cone inverted: the width at the mouth and the height being equal, the width at the bottom may be one-fourth less. Pots of this form pack together so well that they may be carried a great distance without breakage, and when in use may be inverted on the hand and given a tap on the edge of a bench, the soil slipped out, the root examined, drainage re-arranged if necessary, and the pot replaced. This is impracticable with the pots having curved sides, which the tropical potter commonly makes; the drainage hole is usually at the centre of the outwardly curved bottom, although greater stability would be obtained by curving the bottom inward and making one or two holes at the side to permit superfluous water to escape.

Having provided the best pots obtainable, the first operation is to make the drainage. For this purpose, potsherds broken to a convenient size should be arranged with the concave side downwards; on this a coating of some fibrous materials or dry leaves should be placed to prevent the soil from going down; this having been pressed slightly, is ready to receive the soil specially prepared for the plant to be potted.

POTTING SOIL.- As the quantity of earth that a plant pot has available may be much less than the same plant would make use of in the open ground, it is important that soil for potting should have a large quantity of its constituents in a soluble form. On this account, grass turf with abundant fibrous roots, that has been stacked for a year with the grass downward, is preferred for potting soil, but in many places in the tropics soil of this nature is not procurable, and the best available potting soil is made from green weeds gathered with soil on the roots, with dead leaves and stable litter, the whole placed in a pit, covered with surface soil—

preferably from the bank of a river—and the mass kept moist six months or more. If sand be available, it may be used liberally to keep the soil open; in its absence, quartz sand, old cocoanut fibre, or pounded bricks may be used for the same purpose, and cow-dung that has been drenched with lime water to bring out all grubs, may be added to the compost to the amount of one-third to one-half of its bulk.

THE CHEMICAL COMPOSITION of such a soil, air dry, is given by W. Ivison Macadam, Analytical Chemist, Edinburgh, as—

Organic matter and water,	14·17
Ferric Oxide ($\text{Fe}_2 \text{O}_3$),	2·54
Aluminic Oxide ($\text{Al}_2 \text{O}_3$),	1·72
Calcic Oxide (Ca O),	1·11
Magnesian Oxide (Mg O),	0·16
Potassic Oxide ($\text{K}_2 \text{O}$),	0·03
Sodic Oxide ($\text{Na}_2 \text{O}$),	0·01
Phosphoric Anhydrite ($\text{P}_2 \text{O}_5$),	0·62
Sulphuric Anhydrite (S O_3),	0·28
Carbonic Anhydrite (C O_2),	0·13
Chlorine (Cl)	0·01
Clay and sand,	79·22

100·00

And that distinguished chemist remarks:—"This soil contains, therefore, all the ingredients necessary for the life of the plant, but in many cases the quantity is very minute and sometimes not readily available; it is better to give the plant from time to time more or less plant food." A handful of dissolved bones and saltpetre thrown into the water-tank from time to time will supply what is wanted.

RE-POTTING.—If the roots of plants to be re-potted are closely matted, it is advisable to open them out gently with a pointed stick. If the roots are very fine

and wiry, the soil in the pot should be put in firmly, and carefully packed, leaving a fair space at the top for water. If the roots are thick and fleshy, the soil may be filled in loosely with advantage. Bulbous and tuberous rooted plants may generally be shaken entirely out of the old soil. In re-potting plants with fine fibrous roots it is sometimes found that the previous soil has become dry enough to resist water applied in the usual manner; such dry balls of earth it is advisable to place in a tub of water, for some hours previous to re-potting, because the dry earth resists water, and may remain dry while the new soil is sufficiently wet.

GHAGAR, GHARA, MURKA.—The globular small-mouthed pots, about six inches diameter, which are prepared for domestic purposes, have many uses in the garden; the sides being very thin and porous, for many plants there is no necessity for making a hole in the bottom, superfluous water finding its way through the walls as fast as is desirable for many purposes. In such pots, mango seedlings which have been germinated on a rock covered with leaf mould, may be planted, and ivy geraniums intended to be hung up, also the seeds of *Convolvulus arvensis* and *Ipomœa tridendata*, or *Ipomœa biloba*, may be sown, and after they have grown somewhat, may be hung up at the front of the veranda, the hanging shoots of those plants being very graceful in such a position. By sinking such pots into the ground, and filling with water occasionally, a great saving of water is effected.

The bridal wreath is usually formed of myrtle ornaments in Germany; it is made of orange blossoms in France, as well as in Britain and America; in Italy and the French cantons of Switzerland, it is of white roses; in Spain, the flowers of which it is composed are red roses and pinks; in the islands of Greece, vine leaves serve the purpose, and in Bohemia rosemary is employed.

NOXIOUS INSECTS AND GARDEN PESTS.

THE rapidity of plant growth in hot climates is counterbalanced by insect life, and much special study is necessary to control the destructive action of pests.

As an introduction, it may be desirable to recall the life history of the TUSSAH SILK-WORM, which may be observed in all its stages with pleasure and instruction.

The Tussah Silk-Worm is one of the true insects, in which the *larva* or worm stage (which feeds voraciously), the *pupa* stage (during which a remarkable change is effected), and the *imago* or winged form, are distinct. The enquiry may be commenced with a handful of cocoons gathered from the forest, and food in the shape of young, leafy branches of Nandruk,¹ Ber,² Ain,³ or *Chinai-mindhi*,⁴ should be at hand. Either of those trees is suitable, but whichever be selected must be adhered to, as the worms do not readily change from one kind of food to another. A hamper lid suspended in the veranda, and protected against birds and rats, is a convenient means of feeding the worms. The cocoons being placed on the tray, in due course the large moths emerge; the sexes meet, and eggs are affixed in abundance to convenient objects. A few days later, the small worms emerge, and must be immediately provided with fresh young branches of the plant selected as food. The worms will eat freely, and require fresh branches daily, the dried ones being removed as the worms leave them for fresh. Rapid growth and several moults take place, after which the worm appears a brilliant green, with nine golden specks marking the openings of the breathing tubes on each side of the body; and after ten weeks' almost incessant eating, having attained the

¹ *Ficus Benjamina*. *Nandruk*. *Itty-alu*. *Yerra-juvi*.

² *Zizyphus jujuba*. *Ber*. *Bore*.

³ *Terminalia tomentosa*. *Ain*.

⁴ *Lagerstrœmia indica*. *Chinai-mindhi*.

size of the forefinger, the larva begins the formation of a cocoon from the liquid which distends its body being passed outward through two ducts, forming the silken fibres which form the cocoon and envelop the greatly contracted caterpillar. In this *crysalis* state it remains quiescent a few months, then the *imago* pushes the fibres aside and emerges a large moth, prepared to give rise to a new generation and finish its own transient role. Thus four stages may be observed—*first*, the EGG; *second*, the LARVA, which eats voraciously and spins the COCOON; *third*, the CHRYSALIS, enclosed in its silken guard, the source of a valuable textile fabric; and *fourth*, the IMAGO or winged and sexual stage, encompassed by the Tussah silk-worm within one year.

From this account of the life of one insect, the occurrence of worms in fruit may be understood. The parent insect in many instances lays its eggs within the skin of a young fruit: the young maggot is hatched and grows in the fruit, feeding on the provision for it close at hand, until it eats its way out or arrives at the *imago* stage, when it may fly away, as in the Bunga mango. Often small tumours may be found on leaves, which, when opened, disclose a worm which has been reared in a similar way, and observation of the pomegranate fruit discloses a remarkable instance of this nature. An egg is deposited under the skin of the young fruit, the larva eats the fruit until instinct shows that continued eating would cause the fall of the fruit and destruction of the enclosed maggot; it thereupon eats its way out, ascends to the fruit stalk, and with silken thread lashes the fruit to the branch, and returns to continue eating in safety.

TO PREVENT WORMS IN FRUIT.—Gather all fruit that has any sign of worms and destroy it in any convenient way—the Kashians feed pigs on fallen oranges—and induce neighbouring cultivators to do the same. The supply of that insect will be much less the following year. There is no feasible plan known which will prevent the development of worms

in the fruit which have been hatched as described. The parent insect being winged, tar and other viscid substances on the stem will not prevent the insect from having access to the fruit.

THRIPS.—Minute white or black insects, with fringed wings, that infest the undersides of the leaves of many plants, especially tea and crotons, when crowded near a house or in a veranda, and work much mischief. Washing with soapy water at frequent intervals, with a sponge, keeps down the pest, and kerosene emulsion sprayed is also effectual.

GREEN FLY—*Aphis*, *Gunduki*, *Tanki*—is a little insect, often green, but of a great variety of colours, found in myriads on the tender shoots of rose trees and other plants at certain seasons. Washing with soapy water or spraying with kerosene mixture (page 80) kills them. Sparrows and lady-birds eat them, and ants milk them, as described by Huber:—

“The abdomen is furnished with two hollow tubes at its posterior extremity, from which a drop of transparent liquid frequently exudes. It partakes of the property of sugar, and is much sought after by ants, who suck it with avidity from the living aphides. The desired liquor seems to be given out voluntarily by the aphis when solicited to do so by a gentle tap from the ant’s antennæ.”

For the wonderful system of breeding, in which one fecundation produces five generations, so that one single mother may be the means of producing 5,904,900,000, see the *Encyclopaedia Britannica*.

The RHINOCEROS BEETLE—*Oryctes rhinoceros*—bores into the bud at the top of palm stems, disfiguring the leaves and sometimes destroying the tree. Kerosene mixture squirted into the hole causes the beetle to come out, then it may be caught and thrown into a pot of tar.

EELWORMS, nearly related to, if not identical with *Tylenchus devastatrix*, are common causes of swellings of the stems of plants, and are very destructive. The animal is a minute, white, worm-like creature, about one-twentieth of an inch in length. The best cure is the fire.

The STAG BEETLE, the GOAT MOTH, and the WOOD LEOPARD MOTH, or allied species, are abundant in warm climates, and may be recognised by the goat-like smell of the former and the rough wood chips which all the species produce at the entrance to the long tunnels which they bore in the timber, in which the caterpillars live several years. If the chips are rubbed off, the caterpillar may be seen and picked out with a thorn or a little kerosene may be squirted into the hole. If the paraffin reaches the insect, the caterpillar comes out, but it may be beyond reach. If the tree is not specially valuable, it is better to cut it down and throw it into a water tank.

TOMATO WORM. —A green caterpillar attaining $2\frac{1}{2}$ inches in length, having three pairs of legs, four pairs of prolegs, and a raised horn on its rear. May be caught with a pair of nippers.

ANTS. The black and red species of ants feed on animal matter, honey, and the juice of ripe fruit, and are rarely directly injurious to plants; but they carry *aphids* and *scale* from one plant to another, and they also carry the spores of fungi from one over-ripe fruit to another, and spread destructive moulds. Alum is an effective deterrent. It may be dissolved in water and used freely, but should not reach the roots of plants.

COCKROACHES destroy the tender shoots and flowers of many plants, especially the tender shoot of germinating tea seed, and may be caught by children who poke a straw into the hiding place and cause the insect to come out.

DUNG BEETLE.—The large grub of the dung beetle, scavenger beetle, and many others of similar habit, are very destructive to the roots of plants, and are encouraged by leaving manure exposed during the rainy season, when the large beetles lay eggs in the manure and make it quite unfit for use unless it be soaked with lime-water, which causes the grubs to come to the surface. Liberal watering with lime-water, prepared by soaking quick-lime in water is an effective remedy if crows are at hand to pick up the grubs as they emerge from the soil.

WHITE ANTS—*Termites*—destroy white wood plant stakes and labels, and eat up *dead portions of plants*, and being seen in connection with dying plants are credited with the mischief that is due to different causes. Ant-hills are unsightly in a garden, and may be removed by levelling down the ant-hill and flooding with water three times within a week. Should the ant-hill be abandoned by termites, snakes may have taken up residence in it, and precaution is desirable. Corrosive sublimate (perchloride of mercury), dissolved in spirits of wine or water, is an efficient preventive against white ants.

It has been suggested that termites “poison” soil with formic acid. Possibly they do for a time, as there is seldom any vegetation on an ant-hill, but the acid must be easily decomposed, as my experiments with sugarcane showed ant-hill soil was equal to the best manure.

RED SPIDERS—*Tetranychus telarius*--and allied species, are mites distinguished from true spiders by the head and abdomen forming a solid mass, individually minute enough to be scarcely visible to the naked eye, but collectively sufficient to injure melons, cucumbers, tea, and other plants. The mite is reddish or yellowish, spins a faint web, and has four pairs of seven-jointed feet. Kerosene mixture, applied in spray to the lower side of the leaf, is usually effective.

MILLEPEDES, of the genus *Julus*, are worm-like, brown, hard, many-footed, and may be seen in dense swarms running over and over each other during migration to fresh fields and pastures new. Found on dead plants, the *mali* believes they are the cause of the injury; but their chief food is decaying vegetable matter, although at times tuberous roots in incipient decay are eaten. Potatoes may be used to entrap them if necessary.

“SCALE.”—The life history of this remarkable insect is thus described in the *Encyclopaedia Britannica*:—“We frequently perceive on the branches of various trees multitudes of small rounded bodies resembling scales, adhering closely to the wood, and presenting no indication of any external organs. These are insects of the genus *Coccus*. The larvæ of both males and females, on first quitting the egg, are tolerably active, and run about among the leaves and branches. They are, however, so extremely small at that period as not to be distinctly discernible without the aid of a microscope. They are flat, oval, wingless, with short and indistinctly articulated antennæ. The males have no apparent organs of manducation (chewing), although the females are furnished with a small, extremely short, almost comical beak, inserted between the first and second pair of feet, nearly perpendicular in its direction, and composed of a four-jointed sheath containing a sucker of three pieces. It is with this instrument that they pump the juices of leaves and tender stems. They fix themselves, to change the skin several times; and when a certain size is attained, become definitely attached to some chosen spot, where they form a little nest protected by a tapestry of cotton. They then attain the perfect state, and are apterous (we speak of the females) even in that otherwise complete condition when, the insect having attained its full growth, the abdomen is found filled with a multitude of minute eggs. The larvæ of the males are less

numerous; their mode of sustenance is not distinctly known; but they increase in size, and after a time the skin hardens and serves as a cocoon, in which they undergo their transformation to the nympha state. In spring the nympha comes forth: it has a pair of long wings attached to the thorax. The male is less than the female, but more active. When perfect, it sets off in search of the other sex, which still remains fixed. The oviposition of the female is another remarkable peculiarity of these insects. Though excluded from the body, the eggs do not appear externally, but are made to pass beneath the abdomen and between it and the cottony tapestry above alluded to. In proportion as the insect becomes empty, the lower surface of the abdomen approaches the upper one, so as to leave beneath the body of the insect a kind of arch or cavity for the reception of the eggs. The perfect female never stirs a step, and having laid her eggs she dies. Her body shrivels up and forms a covering for the incipient young."

To act against "scale," protect ladybirds, cut off and burn as many branches and leaves as may be done without injury to the plant, dress all that remain in a thick coating of *shen* the mixture of soil, cow-dung, and water used for floors. When this covering is removed a month later, the plant will be found clean.

LOCUSTS—*Tol Gryllus migratorius* if flying, may be kept off by burning smouldering fires of tar and green twigs of the milk-bush to windward of the plantation to be protected; but, if on the ground, a deep trench should be dug across their path, and kept filled with burning straw the insects will drop into the trench; or, the trench may be guarded on the off-side by a wall of waxcloth, or smooth sheets of iron, which the locusts are unable to climb, and fall into the trench. A spray of Paris Green, or London Purple, may be applied to the crop on which locusts are advancing in the wingless stage. Agave infusion (page 80), may be tried against locusts, with a probability of usefulness.

MEALY BUG—*Dactylopus adonidum*—and allied species, mealy insects, which increase rapidly, and injure plants by sucking the sap. On a small scale, a strong jet of water, applied at short intervals, is often sufficient to remove the pest, but on large plantations, the application of Kerosene Mixture or Rosin Wash is desirable.

LADY-BIRDS.—Small red beetles, with black spots, which abound during the rainy season, live on green fly and other insects, and distinguished by the foot having two joints. Another small beetle having colours similar to the lady-bird, which eats holes in the leaves of cucumbers and melon during the rainy season, may be distinguished by its three-jointed feet.

ROSE-CHAFER is a beetle which eats the bark of small branches of the rose, and works serious mischief. Fortunately, they are not very numerous, and are easily caught. Take flower-gathering scissors in one hand, and a tarry pan in the other; catch the beetles and drop them into the tar.

The larvæ of many moths and butterflies are very serious pests in gardens. Caterpillars are produced immediately from the egg: they are furnished with several pairs of feet, and have the shape and appearance of a worm. One small sort attacks rose trees in great numbers at times; to cut off and burn the infected branches is the best remedy. When that course is not advisable, an infusion of tobacco sprinkled over the plant frequently will prevent their attacks from making progress. A large, purplish looper-caterpillar, which feeds chiefly at night, or early morning, and attacks rose-buds, eating into the heart of the bud at its base, and destroying it, is a formidable enemy. It drops to the ground if disturbed, ready to go up the stem again the first opportunity. A light and a pair of scissors employed before daybreak, is the suggested remedy.

LACKEY MOTH CATERPILLARS make a covering of threads of silk, and live under it while young, going out

during the day and returning at night, and changing colour as they grow. Catching by hand is the best remedy.

PHYLLOXERA VASTATRIX is an aphid with the remarkable habit of that group of producing several generations from one meeting of the sexes. It lives on the roots of the grape vine, and did serious injury a few years ago. Finding allied species that are not subject to the insect, and grafting the good fruit-bearing vine on such, is an effectual remedy.

WHITE FLY—*Aleurodes vaporarium*—abounds on tomatoes and other plants. Sulphide mixture makes the pest disappear.

DODDAR—*Thokra*, *Akaswel*, *Binmul*, *Cuscuta*—are climbing, leafless parasites which germinate in soil but soon cling to a host plant by means of suckers; then the root dies. It is very destructive to Lucerne, and if mixed with the seed must be separated by a sieve and the *Cuscuta* burned.

The BROOMRAPE—*Orabanche indica*—attaches itself to the roots of the brinjal, tobacco, and other plants of the Solanaceous family, and having no roots, leaves, or green colour, lives by robbing its unwilling host. When this parasite attacks the brinjal, it is advisable to pull up and burn all the plants, and use the plot of ground for other families of plants during several years, until the seed left in the ground has germinated and died through absence of a suitable host.

INSECTICIDAL PREPARATIONS.

For sucking insects, such as aphids, scale, mealy bug, etc., NAPHTHALENE MIXTURE—soft soap, 6 oz., dissolved in 1 quart of water; naphthalene, 10 oz., mixed with 1½ oz. paraffin: the whole mixed together thoroughly, and, when required for use, 1 lb. dissolved in 5 to 10 gallons of water and applied in spray or with a brush. This

preparation has the advantage of portability and convenience in unskilled hands, as it keeps in the solid form, and need only be dissolved in water for use.

KEROSENE MIXTURE.—*Soft soap, condensed milk, treacle or gur*, each 1 lb.: dissolve in boiling water, add while hot, but away from a fire, one-tenth gallon of *kerosene oil*; churn thoroughly. For use, add 10 gallons water. The object sought in the above is to prepare an emulsion of kerosene or paraffin oil in which the oil is divided into minute globules mixed intimately with the other ingredients, and continual churning while in use is essential for its maintenance as an emulsion and gum. Linseed, *gokru*, tamarind seed, or cow-dung may be used as an emulsifying agent.

ROSIN WASH, as prepared by the Agricultural Department, United States, America, for use against scale on orange trees, has been found effectual. *Rosin*, 2 lbs.; *caustic soda*, 70° strength, 9½ ozs.; *fish oil*, 5 oz. The ingredients are boiled together with water until dissolved with stirring; then boiled an hour, cold water being added from time to time to prevent boiling over; then the preparation is mixed with 10 gallons water.

KEROSENE AND SALTPETRE MIXTURE. *Soft soap*, 2 oz.; *saltpetre*, 1 oz., dissolved in 1 pint boiling water; add 1 oz. *kerosene*, churn thoroughly, and for use add 100 parts water.

SULPHIDE MIXTURE.—An excellent dressing of varied use is made from *paraffin* or *kerosene*, 1 oz. to 1 gallon soapy water, and 1 oz. *pottasium sulphide* to a quart of hot water. Dissolve, mix, and stir well.

AGAINST CATERPILLARS AND OTHER BITING INSECTS.—The leaves of the following plants, crushed and soaked in water a few hours, form a liquor that, if applied fresh, deters the majority of biting itsects. If kept, fermentation sets in, and the composition changes

rapidly. Aloe, datura, henbane, tobacco, tomato, sisal hemp plant. The later is *agave sisalana*, and the only agave tried—it is probable that other species of agave and furcroea—known as *kantula*, *bilayati*, *ananus*, etc.—will be equally effective. 3 per cent. of the sap is a safe quantity.

Grubs at the root may generally be cleared out by repeated doses of lime-water, prepared by putting freshly burned lime in water. The clear liquid is usually sufficient. When this fails, holes ten inches deep may be bored by pressing a stick into the soil, and a $\frac{1}{4}$ oz. of bisulphide of carbine poured in, and the hole covered. This will destroy all grubs within a radius of a yard. Unfortunately it kills friends as well as foes. White ants (termites) may be cleared out by the same means.

Acorus calamus, *yekund*, grows freely wherever marshy soil is available. Its powdered root is deadly to insects, and is used to protect clothes.



GARDEN EDGINGS.

Further notice of the plants referred to will be found by reference to the Index.

EDGINGS are intended for the demarcation of spaces allotted for particular purposes, such as the flower beds of a garden. Should those be cut out on turf, as is the favourite system in temperate climates, no special edging is necessary, but otherwise some means of delineating the flower bed is needful.

Should the garden be near a house with architectural pretensions, the garden edging must be in keeping with the building, and a neat tile of unobtrusive colour is preferable. In such a case, if the soil be sandy, the tiles will not be disturbed by the contraction and expansion of the earth as it absorbs or gives up moisture; otherwise it will give constant labour to keep it in its intended position.

Dwarf plants of slow growth, such as the box-tree, are not abundant in tropical countries, and the list of suitable plants is limited. In a warm climate without excessive rainfall, *ALTERNANTHERA AMABILIS* is nearly perfection. It grows freely from cuttings planted where required as an edging, and its rich colour is charming. As an edging for a large space, the breadth may be increased up to fifteen inches with most satisfactory effect. It needs frequent watering in dry weather, and occasional clipping.

The WIND FLOWER—*Zephyranthes rosea*—is adapted for a climate similar to the above, and may be planted from two to two and a half feet in breadth as a margin to a large shrubbery or group of trees, with most excellent effect, and is also useful in a narrow line to break the monotony of an edging of bricks or similar material.

COLEUS—a very dwarf form of coleus, with distinct colours and given to flowering so freely that it appears blue from a distance—is an excellent broad edging or groundwork for a flower bed, with taller subjects at intervals.

The **FAIRY ROSE**—a miniature China rose attaining about one foot in height and bearing small double flowers nearly all the year round—is also adapted for a warm climate with scanty rainfall and irrigation. It is specially adapted as an edging to large beds.

JUSTICIA GENDARUSSA--*Jugat madan, Tew*—is a hardy edging which enjoys heavy rainfall, and may be kept eight inches in height.

PLUMBAGO CAPENSIS—*Chitrak* makes a neat edging for a wide road in a climate such as Bangalore in India, or in its native country, South Africa.

PEDILANTHUS TITHYMALOIDES grows well under very heavy rainfall and does not object to shade.

PILEA MUSCOSA makes a neat edging for a flower bed in a shady position. Propagate by cuttings planted where wanted to remain.

GOLDEN FEATHER makes a nice edging [at] hill stations.



FENCES.

THE selection of a plant for fencing purposes suited to local circumstances, so as to avoid waste of labour in maintenance and ensure elegance in effect, needs careful consideration. Very often a wall or an iron fence is cheaper than any living one when the immediate usefulness of the one and the cost of maintenance of the other is considered.

In planting a fence, it is advisable to open a trench two feet in depth and eighteen inches in width, the upper twelve inches of soil being placed on one side of the trench, the lower on the other. On the bottom may be placed six inches of town sweepings, and a liberal quantity of the same may be mixed with the soil from the upper spit of the trench and the mixture placed in the trench. The lower soil from the trench should be neatly arranged on the surface, forming two lateral ridges a few inches from the central line in which seed or cuttings may be planted; the resulting channel being blocked at intervals forms a watering trough.

ACACIA FARNESIANA—*Kusturi*, *Vitkhira*, *Guyababula*, *Eri-babula*.—A shrub having globular acacia blossoms with an agreeable odour, and cultivated in Southern Europe for its perfume. Propagated by seed, it grows well on a deep soil in a dry climate, without watering after the first year, and thrives from the altitude of the shore at Madras to 5000 feet.

ÆGLE MARMELOS—*Baël*—makes a slow-growing, thorny fence. Propagate by seed.

AGAVE WIGHTII (formerly *Agave vivipara*)—*Guipat*, *Guital*—makes a strong, rough fence, and its long leaves are useful for tying purposes; but it sends out fibrous roots which impoverish the ground on both sides to a considerable distance.

BALANITES ROXBURGHII—*Hingota, Hingenbate*—thrives on dry, gravelly soil without special watering. Propagate by seed.

BAMBUSA ARUNDINACEA—*Vedru, Bans, Bas, Kul-luck*.—In moist districts, where this bamboo thrives, fences may be made by planting the lower part of the stem, but it sends out surface roots to a long distance and ultimately makes the cultivation of other plants within twenty feet unprofitable. In dry districts it thrives on good soil if watered until the plants are well established.

BIGNONIA STEMS makes an excellent fence for a position where cattle are not abundant. It grows well fully exposed to the sea breeze at Bombay, or, in good garden soil, it thrives in the dry climate of the Dekkan. It is propagated by seed and cuttings.

BOUGAINVILLEA SPECTABILIS makes a grand fence on a deep, rich soil. The climate may be moist, as at Bombay, or dry, as at Hyderabad, Sind; at both of these places good fences may be seen. It is necessary to erect a trellis, and train the climber on it. If the trellis be of bamboo, the climber will be strong enough to stand alone by the time the bamboo has decayed. Propagate by layers, and plant six feet apart.

CÆSALPINIA PULCHERRIMA—*Shankeshur*—the “Flower Fence” of the West Indies, is a most beautiful shrub, which forms an excellent fence; thriving especially on a deep, stony soil, with occasional watering if in a dry climate.

CAPPARIS SPINOSA, the Caper-bush—*Kabax, Kavari*—is widely distributed, and makes an impenetrable fence. It bears heavy rain well, and its variety, *Capparis spinosa variety galeata*, grows on the seashore.

CARISSA BISPNOA, the Natal Plum, is excellent for fencing in sub-tropical climates. It is propagated by seed.

CARISSA CARANDAS—*Karwanda*—is an excellent thorny fence plant for hilly districts with heavy rainfall.

CASUARINA MURICATA.—In a very sandy soil, or in any good soil of an open friable nature, and with a good supply of water, this tree makes excellent fences if kept regularly cut and trimmed. It may be propagated by seeds.

CITRUS ACIDA—*Jambooree, Jambira*.—In a deep soil this useful thorny shrub forms a most excellent fence, easily kept down to five feet. To make a fence of this plant, prepare the ground as noted at the beginning of this section, and sow fresh seeds as they are taken from the fruit, two inches apart, in the line they are to remain in. The object of sowing the plants where they are to remain is to preserve the tap root, which is so essential in a dry climate, as it goes deeply into the ground where moisture remains available, if suitable preparation of the soil has been given.

CITRUS TRIFOLIATA is used for fences on the Riviera, and in mild climates is very satisfactory.

CLERODENDRON ACULEATUM makes a remarkably neat dense fence of slow growth, and requiring little dressing. It grows well at Surat and at Poona, and, if on good soil, does not require watering after the first year.

CLERODENDRON INERME is a beautiful subject for a fence in wet, salt land. It needs a trellis for a few years, but as the trellis decays the plant becomes able to stand alone. For the vernacular names and other valuable properties of this plant, see the page given in the Index.

The CUSTARD APPLE TREE—*Sitaphul, Anona squamosa*—makes an excellent fence in a very dry climate. It is raised from seed sown where the fence is required.

DODONÆA VISCOSA—*Marathe, Zakamee, Amarese Burmbhie*—is one of the best plants for edging to wide roads, and for internal division in a garden or to hide objectionable objects is very useful. If the soil is deep, after the first year it does not require any water, and may be clipped regularly to keep it in shape. It is raised from seeds only, and prefers a sandy soil and a dry climate.

DURANTA PLUMIERI—*Malkangunee*—makes a most beautiful fence, quite impenetrable to cattle and not liable to be eaten by goats. Its lovely blue or white flowers and little racemes of golden fruit are always interesting. It succeeds well in deep black soil, on the Dekkan, without irrigation, if planted carefully as directed previously; but on stony rich soil, with irrigation at intervals, it grows rapidly and gives much satisfaction.

GARDENIA FRAGRANS—*Pedali*—is armed with strong spines, and grows on a poor soil.

HÆMATOXYLON CAMPECHIANUM (the Logwood Tree)—*Patung*—makes an excellent fence, and bears clipping well.

INGA DULCIS, if permitted to grow, becomes a large tree, but may be cut to form an impenetrable fence. It thrives on a deep soil if sown where it is wanted to form the fence, and with care becomes impenetrable in one year.

JACQUINIA RUSCIFOLIA is a most excellent fence plant on a fair soil, with occasional watering in dry climates. It is of slow, bushy growth, and its prickly leaves deter intruders. It is propagated by seed.

JATROPHA CURCAS—*Mogli Yerendi*.—A strong growing shrub fit for use on a loose, stony soil where water is not available. It is raised from seed, which should be planted where the fence is required and watered occasionally the first year.

LATANA ACULEATA makes a very good fence in situations where the rainfall is over fifty inches. The shears require to be used freely to keep it in order. Propagate by seed or cuttings. In Ceylon this has become a weed.

LATANA NIVEA produces very abundantly white flowers with a pale yellow eye, and does not ripen seed as other sorts do. It is propagated easily by cuttings.

LAWSONIA ALBA—*Mendie, Henna, Gounta*—is excellent for fencing, especially on salty soils. In Guzerat it is used for retaining road banks. It is propagated by cuttings, and the clippings find a market as *Henna*, if near a large town.

MALPIGHIA COCCIFERA.—For an edging to a wide road or for an internal division in a garden, few plants are more charming than this dense-growing, free-flowering shrub. It grows nicely from cuttings rooted in a nursery, and enjoys a moist climate.

MYRTLE—*Myrtus comminis, Isbor, Nalayati, Mindi*—makes an excellent fence at an altitude of 3,000 to 6,000 feet. It is propagated by cuttings of the lower branches. A large old bush may often be split up into many pieces suitable for fencing.

PANDANUS ODORATISSIMUS—*Keura, Kea, Kaldera, Magalik*, the male; *Gozdugu*, the female plant—makes an excellent fence for a sheltered position with heavy rainfall. Large branches may be planted, and the fragrant flowers find a ready market.

POLYALTHEA LONGIFOLIA—*Asok, Rat, Devadiri*.—This tree has been very successfully used as a high fence or screen. The seed is planted thickly while fresh in a trench as described before, and thinned out as growth progresses. Rich stony soil and occasional watering while the fence is young is necessary.

POMEGRANATE—*Punica granatum*, *Anar*, *Dalimba*, *Darimba*.—This is a fine fence plant, suitable for a deep calcareous soil and rainfall under forty inches. It is naturally eight to ten feet high, but may easily be kept down to six feet. Propagate by cuttings of the lower branches for the double flowered and by seeds for the single flowered varieties. The bark of the root is a valuable anthelmintic while fresh, hence a fence of it is doubly useful.

RANDIA DUMETORUM—*Gela*—is fit for a high altitude in a wet climate.

ROSE TREE FENCES are very satisfactory for internal divisions, or where goats are scarce, and especially at an altitude of 1,000 to 6,000 feet. On a deep, loamy soil, the hardy rose “Edward” may be raised by planting cuttings, and the “Noisette” roses are also bushy and bearing abundant bloom. These are better propagated by cuttings rooted in a nursery bed.

SERISSA FETIDA is a dwarf, small-leaved plant, used at Baroda to separate the flower garden from other divisions, with excellent effect. It is propagated by cuttings.

TROPIS ASPERA—*Sakhotuka*, *Syora*, *Barinka*, *Karera*, *Kharaoli*, *Rusa*.—A shrubby or scraggy-looking small tree, having alternate, short-stalked, oblong, very hard and rough, saw-edged leaves, which are sometimes used in polishing wood and ivory. It is very common in the districts having a considerable rainfall, and at Baroda and Calcutta is used for fencing, being kept in order by regular pruning. It grows freely from cuttings planted during the rainy season, and afterwards does not require attention beyond trimming.

VITEX NEGUNDO (the Chaste Tree)—*Nirgoondi Sindowara*, *Nishimda*, *Sindooka*—forms a beautiful fence in situations where the rainfall is over fifty inches yearly. Propagate from cuttings or seed.

LAYING OUT GARDENS.

WHEN the community is in a disturbed state, men naturally huddle together for the mutual protection such a condition requires, and the huts of the meanest may be seen abutting on the walls of the nobleman's palace. The cultivator leaves his fields in the evening and joins his neighbours in the village, at the cost of considerable time and trouble in taking his cattle and implements of husbandry to and fro. But, although the habits of a people change slowly, a long extended peaceful state of a country opens the eyes of the nobleman to the value of fresh air, and of the cultivator to the unnecessary trouble he has undergone; in consequence, in countries that have been long blessed by a settled government, the homestead of the cultivator is in the midst of his fields, and the mansions of the rich are usually at a distance from centres of population, in the midst of grounds devoted to the pasturing of cattle, the growth of timber and ornamental trees. The arrangement of the plantations, the water, drives, and paths, is an artistic branch of Horticulture, known as landscape gardening.

The following designs, by Mr. J. G. Jackman, of Woking, England, an eminent landscape gardener, are rich examples of the style of design that has held favour during many years in Western countries. The main characteristic in the designs is a close following of nature in the curving paths and groups of trees and shrubs arranged to hide objectionable and display pleasing features in the landscape. The natural groups become more and more formal as they approach the dwelling-house, gradually breaking from the curves of nature to architectural lines. By a careful study of these plans, much that is objectionable in our gardens may be avoided.

PLAN OF A VILLA GARDEN AND SECTION OF
THE GROUND.

Regarding this plan, Mr. Jackman writes in the *Gardener's Chronicle*:—

“The few observations I shall make on the principles of landscape gardening will be confined to one or two leading points. The plot of ground dealt with is but a small one, and does not admit of a great deal of detail, or the carrying out of any complex idea, as will be observed by a glance at the plan page. The first thing to notice is the shape of the ground, its advantages and disadvantages with regard to its surroundings, levels, aspect, etc.; then, having fixed the sites for the house and offices that are the most convenient for utility and comfort, the next, or second step, is to take note of the surrounding country, and attempt to bring in whatever distant views the limited space will allow, and which should always be considered in choosing the site for a house, although it should not be treated as of the first consequences, for, in *India, exposure to health-giving breezes* is of infinitely more importance.

“Repton wrote, in regard to the prospect from the windows of a house, that ‘we have no choice of moving the point of view; it is fixed, and must be stationary; it is, therefore, necessary to study this with full attention, and to ascertain what are the objects most desirable to form this permanent scenery, and how other objects may be introduced to vary and enliven the landscape always seen from the same spot.’

“The design I have chosen is a corner plot of ground abutting on the high road, which is planted with an avenue of *wad*, *Ficus bengalensis*, and surrounding it on two sides. The house (1) stands in a prominent position, with the ground sloping gradually from it on all sides except the north-east, and has a large conservatory (2) attached to it.

“The lawn (3) in front of the house has been levelled and prepared as a lawn tennis ground, and the walk,

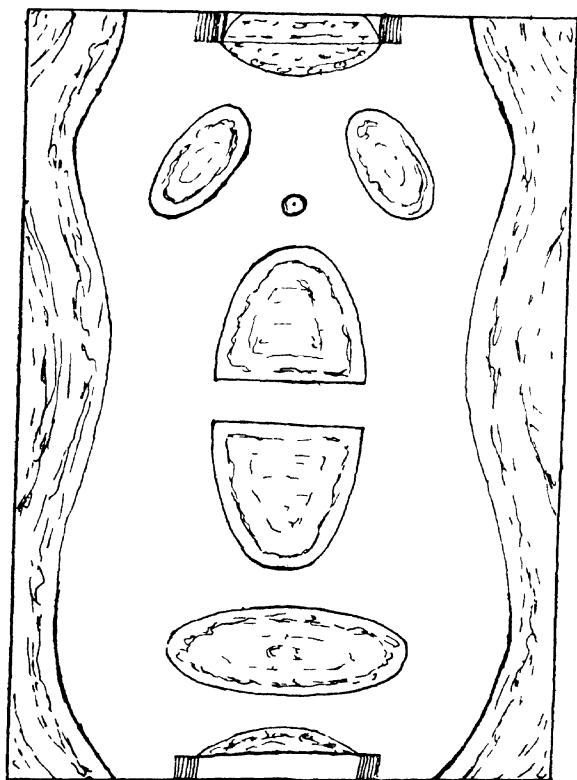
which runs round it, is slightly lowered, thereby giving the two grassed areas the appearance of being both in one piece when viewed from the house or at a distance.

"The summer-house (5) is conveniently situated, commanding good views over the lawn and paddock, besides being an agreeable object as seen from the house; several flower-beds are placed in advantageous positions, so as to vary and enliven the different parts of the ground. The paddock (4) is divided from the pleasure-grounds by an invisible iron fence, which does not obstruct or mar the beautiful views of the hills and other pleasing objects in the distance.

"A group of wild date trees (14) has been placed sufficiently wide apart at the top end of the lawn tennis ground to allow the distant views to be seen, which would have been obstructed if a shrubbery had been substituted. The whole of the grounds is enclosed by an ornamental iron fence and a *Duranta* hedge. The approach is formed as a continuation of the high road, which gives it a fine appearance.

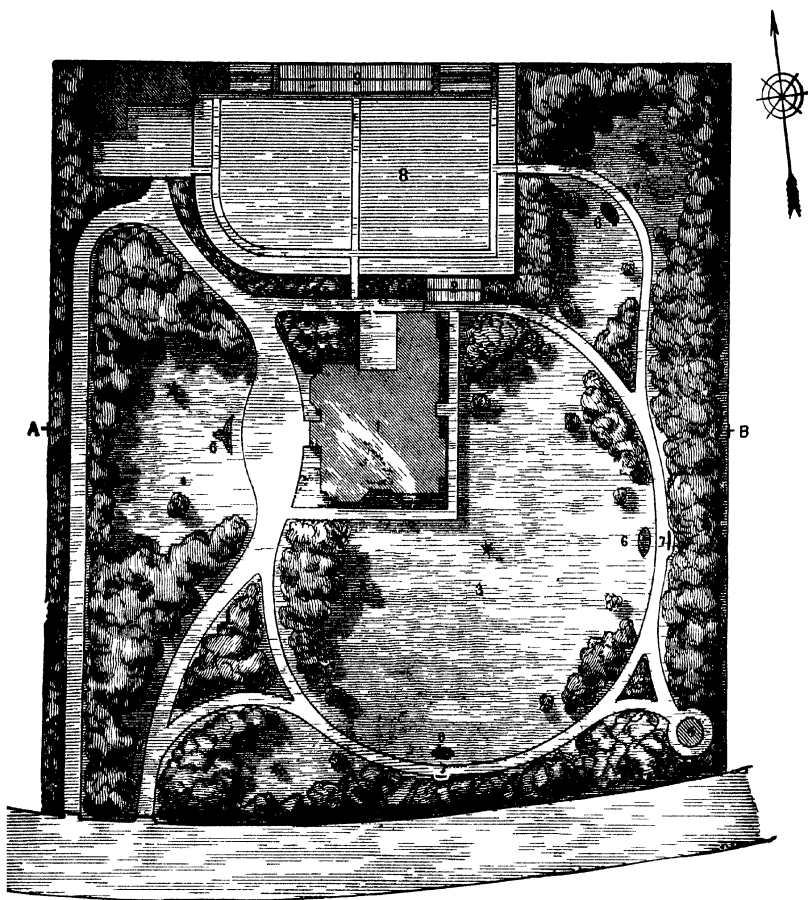
"A convenient road is also made to the stables (9), house, offices, and kitchen garden (10), the whole being well screened, by planting, from the more private grounds. Several ornamental flower-beds planted as carpet patterns are shown (6). The fountain (7), which should always be an object of beauty in a garden, is effective on this side of the house. The beds, situated in recess (8), are planted with rose trees, *Hibiscus*, *Yucca*, *Eranthemum*, and *Croton*, with a margin of *Pancratium littorale* sloping down to *Zephyranthes*, and add pleasant features to the garden in this part. The kitchen garden (10) is of good size, with green-house and vinery (11), frames (12), and potting-shed (13). The letters A, B, on plan, show the line of section."—A. G. Jackman, *Landscape Gardener, Woking*.

The trees named by Mr. Jackman have been altered to suit the climate of India.



A SIMPLE VILLA GARDEN.

Facing page 92.



PLAN OF A VILLA GARDEN

PLAN FOR A VILLA GARDEN.

In selecting a plan for the above, I have endeavoured to choose one which has an outline of ground often met with on estates which are laid out for building purposes, and which comprise plots from two to three acres in extent with only one frontage facing the high-road, the other sides being surrounded by similar sized residences and gardens.

In describing the annexed design, it may be stated that the original surface slopes gradually from the north and north-west, the only view obtainable being from the south, consisting of grass fields and wooded hills in the distance, which will be easily seen from the house (1)—built on an elevated position and surrounded by a broad terrace—as well as from most parts of the ground, by planting judiciously that part of the shrubbery which screens the lawn (3) from the high road for about thirty yards with dwarf-growing shrubs which will not obstruct the landscape.

The positions of the house and stables (12) are fixed in the most convenient situations, and the kitchen garden (8) adjoining is walled in with trained fruit trees, and there is easy access to it from the pleasure grounds and back of house, and also from the stable-yard, to enable manure, etc., to be wheeled into it without coming through the private grounds. It is also of good size, to allow everything to be grown except potatoes, the ground being too valuable for space to be set apart for these.

The site for a range of two vineries and one plant-house (9), with two frames (10) on each side, is shown against the north wall; a potting-shed (11) being built against the stables. The conservatory (2) is also provided for, and is placed conveniently to the house.

A bold carriage-drive is made from the high road to the house and round to the stables, well planted in and screened from the private grounds; and a road is made

for the use of tradesmen going to the stables and back offices.

The lawn (3) is of ample size, and is provided with two large tennis courts. Flower-beds (6) and seats (7) are distributed over the grounds and to brighten up the vistas and shrubberies.

A summer-house (4) is constructed with walks leading to it, and two beds of rose trees (5) in front, which give a very agreeable effect, and insure the space being kept open for view to the lawn.

The shrubberies are planted so as to shut out all buildings on either side and make the grounds private. Several specimen palms, as well as evergreen and deciduous trees and shrubs, are planted on the grass, so as to give it an ornamental appearance. *A. G. Jackman, Landscape Gardener, Woking.*

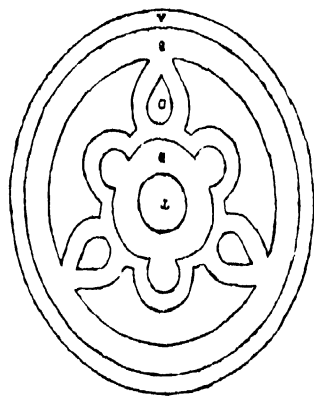
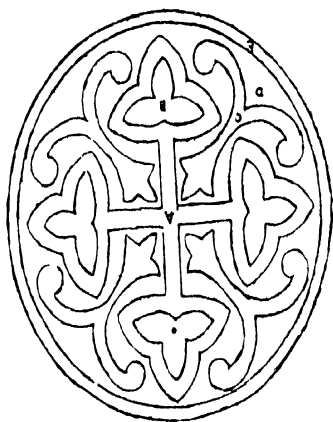
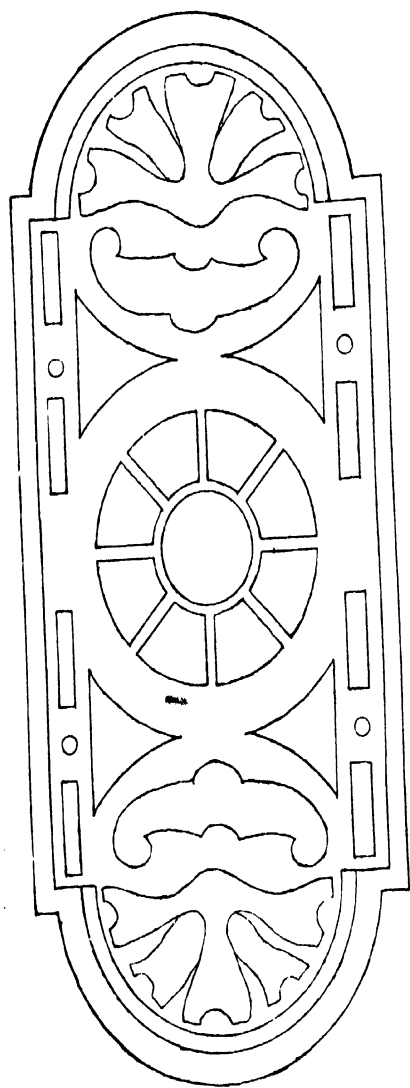
IN GANESH KHIND GARDEN.

The central bed has *Caryota urens* with masses of *Acalypha tricolor* and dwarf fan palms, *Livistonia chinensis*, enclosed by *Hymenocallis littorale*, and a 15 inch border of *Alternanthera* and grey tiles. The four palms in the outer beds are coconut trees, surrounded by *Hibiscus* or sorts and roses.

A DESIGN FOR A COMPOUND OF TEN ACRES.

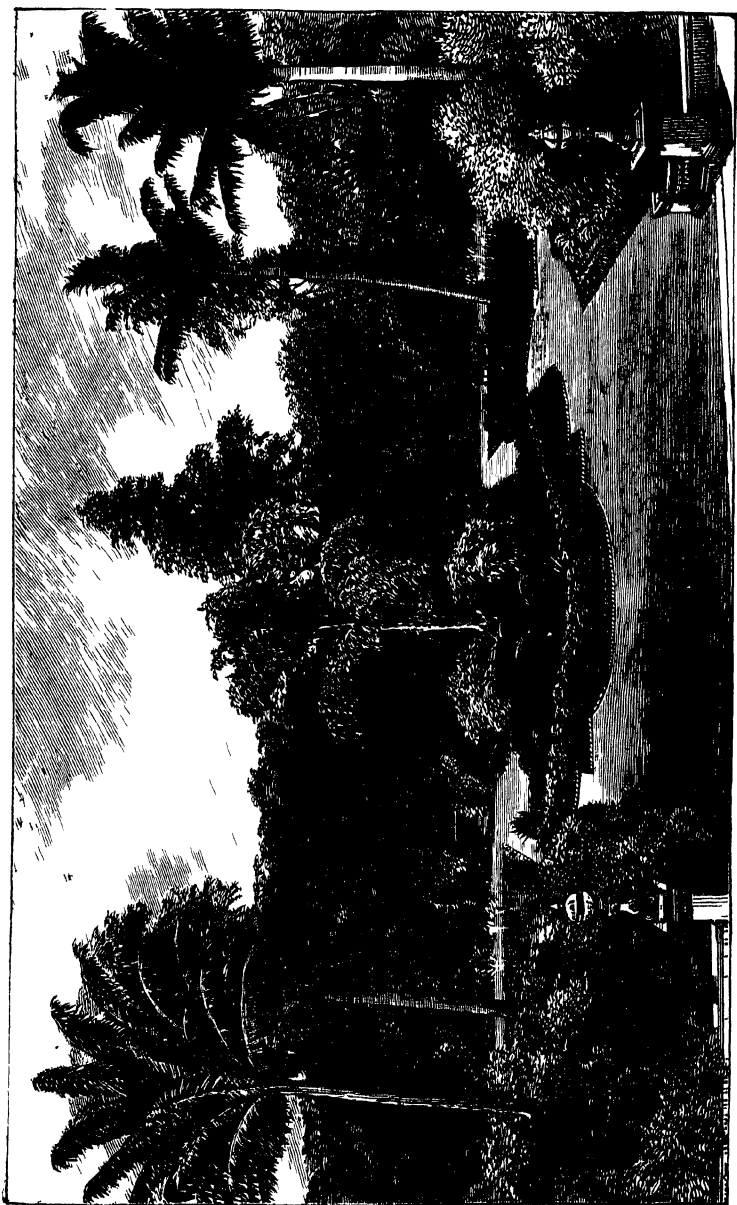
Although this design is stated to be for ten acres, there is no reason why its best features may not be attained on less than half that area, and it may suggest arrangements adapted for a space five times as great.

The principal idea is to obtain as great a length of road with as varied a scenery as is practicable within the limits. Assuming that we enter from (28), the public road, by (27), the gate-house, we find a broad, straight road bearing full upon (21), an architectural ornament, the Conservatory. On the way we pass on the left (26),



GARDEN BEDS

Facing page 4



VIEW IN THE GANESH KHIND GARDEN.

a pond, in which the *Victoria regia*, *Nelumbium speciosum*, *Kummul*, and other water lilies are growing, and water-fowl disporting; it is formed by widening and deepening a rivulet or irrigation canal.

Taking the first turning to the right, we approach the boundary line which the road follows, a part being through (22), an arcade of trellis work 25 feet wide and of the same height, on which the grape vine and a few very choice flowering climbers luxuriate. Passing (13), a group of orange or pomegranate trees, we find a culvert through which a stream flows, and a few yards further (11), the hydraulic ram, a simple and durable machine for pumping water, which goes on day and night without attention, driving water up to a tank on the top of (20), the mansion, whence a full supply of water for domestic purposes and a safeguard against fire are obtained; the force that works the hydraulic ram is obtained by obstructing the stream near the point where it is crossed by the road at the corner.

The overflow is permitted to trickle over (10) the rocky bottom and produce that delightful sound of a falling streamlet, a charming natural melody of priceless value to the hard-worked brain. We pass (9), the lawn tennis court, which communicates with (21), the Conservatory, by paths covered in with lattice work bearing choice climbers and affording the shaded paths so necessary to some ardent thinkers, whose best work is produced while combining quiet physical with mental labour, and (8), a vinery, having the plants trained on the system found most profitable in Britain, where the vines are trained up the rafters of a house covered with glass. In this country the glass is not required, but the system of training has been employed with great success. The place is an excellent shade for children during sunny hours, and the spectators often enjoy shelter that tennis players must dispense with. By (7), a small water tank, passing (14), a group of mango or peach trees, and (15), an arbour or temple, we may reach the back entrance to (20), the mansion, or retaining the wide

road, we pass (6), the vegetable garden, (3) the mallee's house, (2) a tool-house, and (1) a cowshed, (5), the dairy, and (4), the stables and grooms' quarters, (16), the quarters of the house servants, (17), the kitchen communicating with the house by (18), a passage covered with trellis work bearing Marechal Niel roses and the fragrant edible fruited passion flower we reach (19), a small rock-work garden; (23) and (24), the flower gardens, (25), a paddock, in which foals disport or sleek kine browse the dewy herb. The use of (29) and (30) is obvious if the views beyond are uninteresting.

PLAN OF A PUBLIC PARK.

A careful examination of the accompanying plan by Mr. A. G. Jackman, of Woking, England, will show the principles employed in such work better than many pages of letterpress. This plan is alone sufficient testimony to the ability of the designer. The park is intended for a large town; its area is taken at 100 acres, but it might easily be cut in two and its best features retained for a smaller or even for a larger space. On the right a "*terrace*" and "*crescent*" of houses appear, and on the other sides are marked off sites for detached houses. Nos. 1, 3, 4, 5, 6, 8 represent open spaces for cricket and other games. No. 2 is a lake for boating and water-fowl. In a flat country the formation of such a depression is useful for affording material to raise and undulate the surface. The lake is formed by widening and deepening a stream or irrigation canal, and in the instance designed the stream issues from a wood and falls in a magnificent cascade in full view from the road. At No. 7 a Tennis Court, and at Nos. 9 and 10 playgrounds for boys and girls are shown. No. 11 is a Flower-garden having No. 12 a Fountain in the centre and surrounded by Statuary at the points marked No. 13. No. 14 is a large bed of *Lagerstromia* broadly edged with *Amarylis*, which conveniently diverts the road, inducing graceful curves. No. 15

indicates Flower beds which are laid down profusely in proportion to the means of maintenance. At No. 16 the overflow of the lake makes small waterfalls in view from the road, and enhanced in effect by rockwork at Nos. 17 and 18. At No. 19 is a Bandstand. No. 21 a Boat-house. No. 22 Arbours. No. 23 are houses for aquatic fowl. No. 24 Masses of roses. Nos. 25, 26 are retiring rooms. No. 27 a Nursery with propagating sheds to prepare plants for keeping the grounds in order, and the Gardener's House near at hand. The proprietors of the *Gardeners' Chronicle* kindly supplied the plate of the design with permission to print it.

THE MALA, OR HOT-SEASON GARDEN.

A PIECE of well-drained and irrigated garden, with a sandy soil, and enclosed by thick fences, or mats, to keep out the hot wind, and having *Shevari* trees (*Sesbania aegyptica*) in lines 10 feet apart, and bambus tied from tree to tree, at 7 feet in height, on which climbing crops of sorts are trained, and the shaded ground used for growing crops that would not bear the heat of direct sunlight. Cucumber, melon, snakegourd, lablab, and *Chowdari* beans are led up strings and run along the bambus, and many sorts of *baji* crops are grown beneath. Only tropical plants are grown in this way; but the shade and evaporation produce a delightful coolness, with fresh air, during hot weather, and foliage plants develop grandly under such conditions.

The *Shevari* trees require frequent pruning to prevent them from growing too large, and the branches are excellent food for goats. As a substitute, iron pipes, or angle-iron, may be used, and the shade secured by coconut-fibre matting, or split bambus. The place is then a low-roofed conservatory, and is specially useful for nursery purposes, the propagating frames and other glass coverings being secure from excessive sunlight under such a covering.

THE CONSERVATORY.

THE object of the conservatory in tropical gardens is to maintain a cool moist atmosphere, suitable for plants unable to endure the direct sunshine of tropical regions, or the scorching hot wind, or cool dry breeze, which, although not very cold, when tested with a dry thermometer, produces a very low local temperature by the rapid evaporation it causes from a moist surface. The style in which the conservatory is built should harmonize with that of any conspicuous building it adjoins, but the more simple the design, the better the opportunity for the display of graceful climbing-plants. The conservatory here pictured was originally a tennis court, but soon after the photograph was taken developed into a very satisfactory conservatory—its bare poles, clothed in passion flowers and other climbers hanging in graceful festoons, were highly appreciated. The covering was thin coconut fibre matting, a cheap material that is thoroughly efficient as long as it remains in good order, but requires renewal yearly, or at most once in two years. *Chicks*, or *Tatis*, as the screens made of split bamboo woven into a warp of cords are called, also serve the purpose well, and, at Calcutta, a strong wire-netting supports a screen of grass, laid on sparsely, and fastened with transverse bambus, serves the purpose, perhaps, better than any: it has the advantage that the thickness of the screen may be varied to suit the plants immediately underneath; but it tempts the inexperienced to thicken the shade beyond a reasonable degree. It is surprising what a thin shade is sufficient to suit the great majority of plants.

Where a poor soil with abundant irrigation is available, a cheap and efficient conservatory may be produced by planting young *Casuarina* trees in lines twenty feet apart and the same distance apart in line. This produces straight lines of trees from whatever point of

view, and an irrigated crop between the young trees helps to pay for the water used. After a few years the lower branches of the trees may be pruned off, and for practical purposes an effective and durable conservatory is ensured. The walls may be formed of netting bearing climbers to exclude either hot or cold air. The paths should be laid with coarse sand or fine gravel with the earthy matter sifted out, so that water may be applied freely yet the feet may not get wet; and open water tanks should be stocked with fish to keep down the larva of the mosquito.

In deciding the size of a proposed conservatory, it should be remembered that a large house changes its temperature and degree of moisture at a rate proportionally much slower than a small one.

MANAGEMENT OF THE CONSERVATORY.

In this work it is desirable to follow and ameliorate the natural climate rather than attempt extreme alteration. For example, in a hot, dry climate water may be freely dispensed during the rainy season, but during the hot season abundant water tends to rapid, weakly growth, which soon proves its instability. If the hot wind is kept out by moistening the climbers on the windward side, and the paths are sprinkled with water twice daily—in addition to any watering at the root which may be indispensable—it will be sufficient to prevent plants from suffering from drought; whereas, during the rainy season, the natural rainfall of dry districts may be largely supplemented with distinct advantage. The inexperienced is apt to forget that the shade retains gentle showers, and that if plants be in pots the leaves may prevent the rain-water from reaching the root.

THE LAWN.

IN countries with a hot, dry climate, there is no part of the garden more satisfactory than a well kept lawn: it requires abundant water and much labour, but the green surface of short grass is highly appreciated and refreshing. Fine short grass may be produced in a few weeks, but the thick, springy turf that bears traffic without injury requires years of care and attention to produce. The best season for making a lawn is at the end of the monsoon. The ground requires to be dug, cleared of weed roots, drained if the subsoil be tenacious, and brought to a fine tilth on the required surface, either level or with gentle swelling lines; steep slopes being avoided as liable to be cut up by tropical showers. If the soil be tenacious, a dressing of road silt or other gritty matter is desirable; then, if sods are procurable, they may be neatly laid on the moistened surface, beaten down gently, the interstices filled with sand or dry sifted road silt, then watered freely during some days, and rolled while nearly dry in order to avoid making the soil water-tight. But sods are rarely obtainable, and finer results can often be obtained by the following METHOD OF MAKING A LAWN:—

Dig up “roots” of Dog’s-tooth grass¹ *CYNODON DACTYLON*, *Hariati*. *Dub*—chop with an axe into pieces about an inch in length; mix the roots with mud prepared from good soil and cow-dung with sufficient water, taking care that the roots are thoroughly coated; spread thinly on the moistened ground; cover with about half an inch of dry soil, and beat gently down with a wooden beater. 10 lbs. weight of roots to 100 square feet makes a dense sward quickly. The roots may be obtained from a distance, because if

¹ Dog’s-tooth grass grows almost everywhere in warm climates, from England to Australia.

moistened and placed in sacks they remain fresh several days. The colour of Dog's-tooth grass is a pale green, and another grass which grows in company with Dog's-tooth on the seashore at Bombay has a very bright green, and newly-made lawns at Bombay have been specially admired. But *Bombay-achahariali*—*Paspalum distichum*¹—is a succulent grass which gives a fine green while lately planted, but soon dies out, and its place is taken by the wiry *hariali* or *dub* grass which invariably gets admission.

In moist, sandy soils, a small creeping plant of the Verbenaceae family, which grows from South Italy throughout the intervening countries to Ceylon, named *Lippia nodiflora*—*Bukkan*, *Vakkan*, *Buiokra*, *Bokenaka* in Indian vernaculars, and called *Libea* in gardens in Egypt and *Hiramanna doetta* in Ceylon—makes an excellent lawn on sandy soil, and does not require as much watering as grass. It may be planted by chopped roots in the manner described for *hariali*, and keeps a nice green if the mowing machine be used regularly to cut off the small white flowers.

As the lawn is often damp from the usual watering in the evening and from dew in the morning, any plants that are set out on it should be of a sufficiently distinct character to be effective at a distance. In such a position small palms are particularly suitable, and may be raised above the general surface by making a trench at the outline of the proposed plantation, and throwing the soil towards the centre. This increases the depth of soil, and is a convenient arrangement for watering, as the trench can be filled at intervals. The sloping sides of the bed may be turfed or planted with *Zephyranthes* or *Alternanthera*.

¹ *Paspalum distichum* has two divergent flower spikes about three-quarters of an inch in length on its flower stalk. Dog's-tooth or Dub grass has from two to five spikes over an inch in length.

PREPARING FLOWERS FOR EXHIBITION.

IN Horticultural Exhibitions flowers are shown of much larger size than is usual in the garden, and the question often occurs, How is it done?

Successful exhibitors are not only good cultivators, but they usually have a large number of plants of one sort from which to select specimens, and at an early stage, when the flower-buds are distinctly formed but slightly developed, one promising bud is selected for each strong branch and all others removed, and the plant is from that date specially fed with a clear, brown, weak infusion of manure, prepared by soaking a half-bushel of old cow-dung in 100 gallons of water, or by a one-per-cent. solution of true saltpetre or of Chili saltpetre. These stimulants must not be used before the flower buds are well formed, otherwise leaf development will be encouraged instead of flowers, and a very weak preparation frequently applied is more effectual than the opposite. When the flower-buds are well developed, protection from direct sunshine increases size, and a rain-guard protects expanding blossoms. This may be formed by a circle of stiff paper having a section cut out and the edges brought together, and the resulting conical hood fixed to a stake and inserted in a convenient position. An expanding bud may be assisted to open by the judicious application of a small paper-knife, and a too fully advanced one may be restrained by inserting fine wire through the bud so that the petals may not fall.

HORTICULTURAL MYTHS.

SEEDLESS FRUITS.

PRIMITIVE impressions regarding plant life are widely diffused, and the idea that the pith of the plant has a special influence on the production of seed in the fruit, and that to remove the pith is to secure the absence of seed, is widely prevalent, and may be traced to Theophrastus. The pith serves many purposes, but chiefly is a storehouse in which the plant keeps matter not immediately required; the bank in which the thrifty plant stores its surplus means of energy—the starch granules—and also the store in which it places by-products of its industry—the crystals of calcium oxalate and other effete substances—it cannot profitably get rid of. Imperfection of the stamens or pistil, or the absence of a special insect required to convey the pollen from one flower to another, is a more probable cause of the absence of seed in a fruit. The occurrence is by no means rare. Sugar-cane rarely has seed in its fruit; and, fortunately, the same may be said of the banana, the seed of which, when properly developed, being as large as a pea, and produced in quantity sufficient to fill the skin of the fruit, and leave little place for the pulp that is so universally appreciated. The little black specks, which may be seen near the centre of the fruit, are the rudimentary seeds. Oranges, papays, pomegranates, and cucumbers are valued in proportion to the absence of seed. The finest pummelo, the “Sultana” raisin, and *Ba-dana-Ungur*, the black Monukka grape, have no seed, and Guavas, or apples, with few if any seeds, are found occasionally. When such appear, if otherwise desirable, let branches of the tree be grafted to *roots* of the common Guava, and the result will be satisfactory.

That to obtain fine mango fruit, the seed should be soaked in honey and watered with milk, or that, if we point with the finger at a tree, blight will ensue, or that fruitfulness will follow if we use the middle joint of the

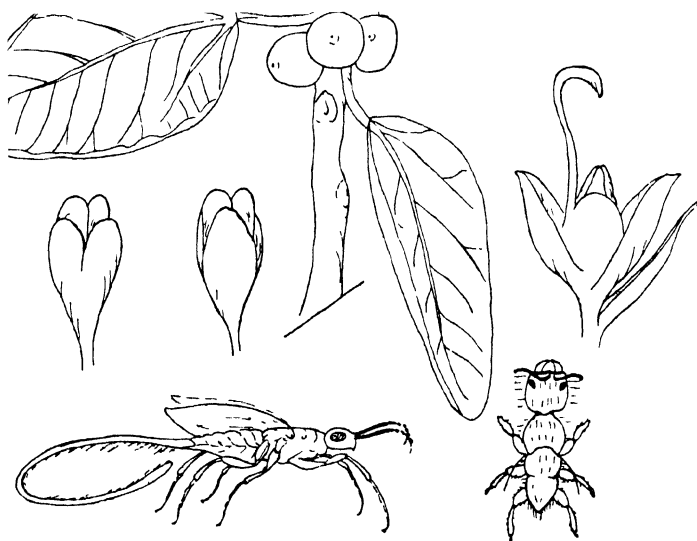
thumb as an index, are equally fallacious with the idea that the grape-vine may be grafted on the prickly pear; but not so amusing as the care with which the Adonis of the garden wipes his hands after gathering the Kohila fruit (*Benicasia cerifera*), because he believes that the waxy secretion on its surface would permanently whiten his moustaches; or that there is any special virtue in pruning the vine by moonlight, at full moon, or from sticking cuttings into a squill to induce early fruit-bearing.

In a former edition, grafting the banana was treated as a myth, but it is doubtful whether this was justified. I have succeeded in grafting the cellular portion at the base of the stems of two distinct kinds of banana, and much regret that the importance of the result did not appeal to me while opportunity remained of continuing the observation. There was no union of the specially fibro-vascular part, and no sign of union of the solid cellular parts at the base of the stem, until force sufficient to rupture the tissue had been used; and the cohering faces proved stronger than the natural tissue. Now, assuming that the union had been maintained, would it not ultimately have developed a bud combining the characteristics of the distinct varieties? This enquiry may be commended to all who seek the advancement of science in connection with Horticulture; but, meanwhile, the assurance that the plant will not be grateful for sugar or honey applied to its roots, and that milk is not more beneficial to plants than the foulest liquid, may be accepted without reserve.

That the juggler's mango-tree "growing" is merely sleight of hand, and not the effect of acid liquid collected at sunrise from fields of gram (*channa*), may appear a superfluous assertion; but there undoubtedly are sane men in our bazaars who believe otherwise, from "the marvels which they see with their eyes shut."

THE ROMANCE OF POLLINATION.

THE pollination of the rudimentary seed or ovule is full of interesting detail, which adds greatly to the value of every garden. The mechanism in the flowers and the external aids brought into use are sufficient to fill several volumes, and the following description of the process as it occurs in the banyan tree is only a specimen of what may be observed any day in an



THE BANYAN GREATLY REDUCED.

Left—Male flowers, showing front and rear ; female insect.

Right—Female long styled flower ; male insect.

ordinary garden. The banyan tree is a species of the fig genus, and has small flowers, with separate sexes produced inside the globular "fruit" or fig, which is botanically a *receptacle* or stalk hollowed out and bearing the small flowers on its inner surface. Let us gather a red-coloured ripe fig from the banyan. The orifice is loosely guarded with bracts, but little insects may be seen coming out, and if we cut the fig open vertically, abundant insects may be seen. If the fig be over-ripe, ants may have come in to suck the sweet juices from the ripe fruit, and another fig will probably serve our purpose better. Here some of the lively contents may jump on to our hands, and by the aid of a lens may be seen emerging from the egg in the centre of a flower. There are several distinct insects found in the fruit of the banyan tree, but some will appear like the illustration, which is drawn from nature by Mr. M'Bhide. The female is a small but very elegant creature in a frock of brilliant purple, and having two pairs of wings, one pair of large compound eyes, and three golden eyelets arranged as a triangle in the centre of the forehead, and, rearward, a long recurved tube which is used for laying eggs. The male, as shown in the illustration, is of loutish figure and dun in colour, with rudimentary wings. The seed is ripe in the seed-bearing flowers, and the male flowers—each filled with a solitary anther with abundant white pollen—are in full blossom. The female wasp preens her delicate wings and, marching round, loads up with pollen and passes out; her powers of flight are more like jumps of eight inches in length, sufficient to place her on the back of a squirrel or a bird to be carried to the nearest tree which has female flowers in bloom. Here she alights, and pushing into the half-grown green fig by the narrow doorway, leaves her iridescent wings sticking in the orifice; and, while laying eggs, the pollen she has brought is placed in contact with the viscid stigma of the blooming female flowers, which are of two forms, one having a long

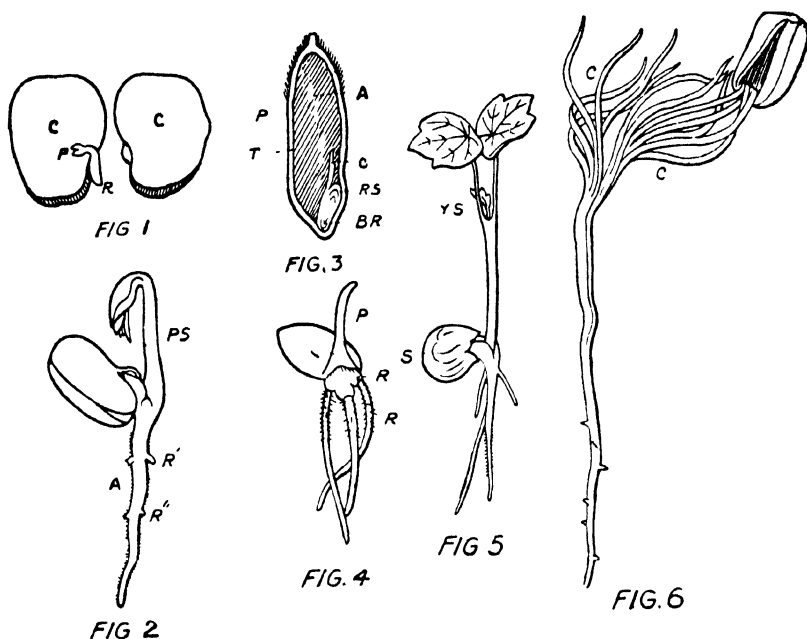
style (as shown in the figure), the other having a style about half as long. The long styled flowers are fertilised by the pollen; the short styled receive an egg, and its presence prevents the development of the seed ovule, and in due season the produce of the short styled flowers is a reproduction of either of the parent wasps, which the tree harbours for the purpose of conveying pollen from one tree to another; and the other flowers, in due course, produce a seed to repeat the plant.



THE LIFE OF THE PLANT.

A SEED is a rudimentary plant usually with a root and a stem: one, two, or more leaves, and a store of food provided by the parent plant, on which the young organism may live until it is able to work for itself. All this is packed together in the seed-coat, and may be seen when the seed has been induced to start growing or *germinate*. This germination is effected by moisture and a suitable temperature acting on a special ferment or enzyme which, in its turn, causes starch and other plant substances to become soluble, so as to pass from one part to another, and form new cells or cell contents as the case may be; the degree of temperature necessary for this purpose varies with the average degree of heat in which the parent plant and its progenitors have lived during many years, and consequently the necessity for this temperature for healthy development has become inherent in particular species. Some seeds will germinate at a temperature slightly above freezing point, others require nearly 80° F., or the mean temperature of tropical regions, maintained with abundant moisture for a considerable period to induce germination.

The time after leaving the parent that is required to pass before the new seed will sprout, also varies considerably. Seeds of balsam may be seen sprouting before they have been thrown out of the fruit, and are always quick in germinating when conditions of temperature and moisture are favourable; others, such as seeds of the primrose, remain a long time in the ground. Some seeds retain the power of germinating only a short time; for example, in the mango tree seed and the onion seed in the tropics, life is very fugacious, but cucumber and melon seed retain germinating power ten years at least, if kept dry, but the stories of seeds, presumably of immense age, found in the wrappings of mummies, and of charlock, dug from a depth of many



GERMINATION OF SEEDS.

FIG. 1.—Bean split open, showing (C) the cotyledons containing food for the young plant.

FIG. 2.—Another kind of bean—showing the split covering; the primary stem (PS); the primary root (A), and its branches.

FIG. 3.—A section of wheat, with (C) its solitary cotyledon; (RS) the rudimentary stem; and (BR) its rudimentary root branches.

FIG. 4.—A wheat seed at a later stage, showing (P) the plumule or young stem, and (R) the branches of the root pushing through a special root-collar.

FIG. 5.—A nasturtium, showing the cotyledons in (S) the seed absorbing food, and the young stem.

FIG. 6.—is a seedling pine tree, showing the numerous cotyledons.

feet from the surface germinating, may be set down to inaccurate observation. A dry condition is necessary for retention of germinating power generally, but for many seeds, notably those of some water plants, and of the orange and lemon, the mango and the seed of the tea tree, to dry the seed as one may dry wheat or barley, would be fatal to their germination. The wonderful stories current in the East regarding the power of the acid water gathered at break of day from fields of Gram (*Chana*, *Cicer arietinum*), in promoting germination and growth, may also be set down to inaccurate observation, and the sleight of hand of a juggler; intelligent readers need not be reminded that, in the words of a well-known professor, "The laws of Nature are not set aside at the bidding of a man in a *dhoté*" (loincloth).

The process of germination¹ generally is this, the vital principle being excited by heat and moisture, the cells of the little plant in the seed begin to divide and re-divide, each becoming as large as its parent, the material for the construction of this growth is a store of nutriment—chiefly starch—in the seed; this becomes soluble, and is taken up by the tissues of the plantlet by absorption. The little root is protruded and passes downward into the earth, the little stem nourished by the food in the seed, holds out its leaves to the air, takes the carbonic dioxide which animals and decaying plants are continually sending forth, by means of its green colour and sunlight, decomposes that gas into its elemental carbon and oxygen, combines the former with water and assimilates the sugar or starch produced, and sets the oxygen free to rejoin the cycle of unceasing change in organic life, or become more or less fixed by union with other elements. The sugar or starch may be changed into cellulose, the material of the cell-wall, or combined with nitrogenous matter and oxide of iron, nitrates, phosphates, sulphates, lime, potash, soda, mag-

¹ Only the simplest form of germination is given.

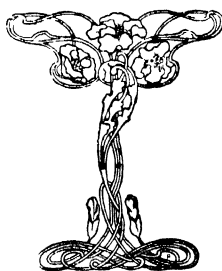
nesia, silica, chlorine, taken up by the root, which form the protoplasmic contents of the cell.

The proportion of mineral matter taken up by the plant is very small, seldom more than one per cent. of the weight of the plant, but always essential to life. Of the essential elements obtained from the soil, the greater part are abundant, but a few are scarce in the soil; and the restoration of the scarce substances is termed manuring the soil. The scarce materials are nitrogen, phosphoric acid, potash, and rarely lime, and usually our source of supply of those substances is the dunghill; but since chemistry has revealed what really is manure, other sources of supply are opened. Nitrate of soda is brought from Chili. Nitrate of potash (*Sorakar*) is prepared in India; phosphoric acid is dissolved out of bones; potash, when insufficiently available from wood-ash, is obtained from mines as *kianit* and other minerals; plants of the pea family, which, by the aid of bacteria, in nodules on the roots, obtain nitrogen from the atmosphere, are cultivated, and lately, by setting up small thunder-storms produced by electrical machines, in imitation of Nature's lightning flashes, nitric acid may be formed and used to fertilise the soil. All plant food must be in a fluid state, hence manures are only useful when dissolved in water.

In due season the plant may reach maturity, and need to leave progeny behind e'er it returns to the elements. It produces flowers which contain rudimentary seeds or ovules in a central cavity, fecundating pollen in convenient stamens, and very frequently a supply of nectar to induce bees to aid the distribution of the pollen; this yellow powder consists of cells containing a special protoplasm, which, by the intervention of an elaborate series of aids, combines with the protoplasm in the ovules, and the result is fecundation, and the young seed having grown to maturity, the work of the parent plant is advanced a stage, either the final one, or the beginning of a long series of intermittent fructification.

AMUSING.

If light be excluded from the green surface of a leaf or a fruit, the chlorophyll or green colour is locally weakened or destroyed; hence the "blanching" of celery and the pale centre of cabbage or lettuce. The exclusion of light has also the effect of inducing succulent growth from the excessive development of short cells and a proportionate weakness of fibrous tissue; but the cause of blanching and of the special succulent growth or etiolation is, in common, absence of light. This fact may be applied for amusement by cutting out a name or device in tinfoil or black paper and affixing it closely to the green surface of a nearly full grown melon or other convenient fruit. In a few days the underlying surface becomes blanched, and the fruit with a name and birthday wishes on its surface is an acceptable gift, creating interest and leading to a useful lesson in plant life.



ROTATION OF CROPS.

THIS term implies the succession in which crops follow each other on a particular field or plot of ground. Experience proves that if crops of one kind be cultivated year after year on the same plot of ground, the return for the labour is lower than when crops are changed in a scientific method. Of the scarce ingredients of the soil, one or two are drawn upon in excess, and the fertility becomes, as it were, lop-sided. An excessive accumulation of one scarce ingredient does not recompense for scarcity of another. As Liebig affirmed, As the strength of the weakest link determines the strength of the chain, so is it the proportion of the scarcest necessary ingredient that measures the fertility of the soil, and if a crop which takes one ingredient in special proportion be followed by another which specially takes a second scarce ingredient, and those two by a third which does not draw especially upon either of the two former to a serious extent, the work of the soil becomes balanced, all the scarce ingredients having been called up in turn.

The value of rotation is an old and widely accepted idea: the husbandman is usually bound by his lease of the land to observe an approved rotation. The Hindoo cultivator grows rice during the rainy season and a pea crop, or some other form of pulse, during the cold season, except where he has water in abundance and grows rice twice a year, with the consequence that his land is reduced in fertility to a point below which it cannot descend with a definite amount of labour in tillage, and his two crops are not equal in quantity to what one crop gives on land fairly treated. In the Dekkan, a primitive system of rotation has prevailed longer than history records. The cultivator drills his corn with a four-furrow drill, while his wife adds a

fifth furrow on one side, sowing pulse of some kind, and as these lines cannot occupy the same ground year after year, the practical result is rotation.

Further, particular crops are subject to special diseases which run in the family, and the germs of those diseases remain alive for a time in the soil on which they have been produced. For example, slime fungus the cause of anbury or finger and toe disease—affects the crucifer family, which includes cabbage, cauliflower, turnip, radish, mustard, cress, knol kohl, and other garden crops; therefore those should not be grown in succession on the same land; and the potato family, among its numerous diseases, is subject to a showy-flowered robber named broom-rape, *Orabanche indica*, which having little if any root and no green leaves of its own, fastens itself to the root of the tobacco, brinjal, tomato, and others of the same family, and lives on the nutriment gathered by the root and leaves of its host, and deposits abundant seed ready to grow and suck nutriment from another crop of the same family of plants. But if plants of another family be set in that ground, the broom-rape seed will die from want of a suitable host plant.

This is an instance in which the facts are obvious to the most casual observer, but parallel instances in which the germs are minute and invisible to the naked eye are very abundant. The fact that many cultivated members of the pea family, by the action of bacteria in nodules on their roots, can make use of the free nitrogen of the atmosphere and consequently require less nitrogen from the soil, has an important bearing on the rotation of crops, and in meadows which at first sight appear an exception to the rule, the plants are not all of one kind: some are deep-rooting, others shallow-rooting, and the plants are continually changing places, and the action of worms raises soil from the lower levels to the surface and brings about ROTATION in another form.

CABBAGE, in rotation, should not be followed by broccoli, brussels sprouts, cabbage, cauliflower, cress, mustard, radish, rape, savoy, turnip.

CARROT may intervene in the above list, but should not be followed by carrot, celery, fennel, parsley, parsnip.

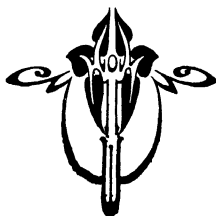
BEANS may intervene in any of the above lists, but should not be followed by beans, peas, lucerne, earth-nut, or any of the pea family.

BEET and MANGEL-WURZEL may be grown between any members of the above lists.

LETTUCE and ONION may intervene in any of the above lists.

POTATO, TOMATO, TOBACCO, AUBERGINE, CHILI, and CAPE GOOSEBERRY are subject to broom-rape, and should not follow each other on one plot of ground, but may intervene in any of the above lists.

BENDY or OKRA may intervene in any of the above lists.



PLANT BREEDING BY HYBRIDISATION AND SELECTION.

A study of the previous chapter on the structure of the flower may be necessary in order to understand the following paragraph.

FERTILISATION of the ovules in a flower is effected by pollen grains which are applied to the stigma, and under the influence of the viscid secretion of that organ, produce tubes which enter the tissues and convey part of the protoplasm of the pollen to the ovules, where other protoplasm is found, and the union results in changes which may ultimately issue as a ripened seed.

Many flowers are bisexual; some plants have the sexes in separate flowers, and some on separate individual plants. In flowers having both sexes, many instances occur in which the pollen of a particular flower is prevented from fecundating the flower of its origin by most interesting combinations of size of parts, and respective time of maturity of the stigma and of the stamens, and honey is produced by many flowers with the evident purpose of attracting bees and other insects to convey the pollen from one flower to another of the same kind. When a showy or honey-bearing blossom is absent as in grass and pine trees, abundant pollen is produced and conveyed by the wind. The fecundation of one flower by the pollen of another, or cross-fertilisation, occurs between plants of several degrees of affinity all more or less close (I.) when both parent flowers are on the same plant, or on such as may ordinarily be produced from the same seed-pod, this normal cross-fertilisation results in fixity and constancy in character such as occurs in field crops grown in particular districts where a special quality of produce prevails, differing in size, colour, and other qualities, and usually ascribed to a peculiarity of soil or climate; for example, of the

hundreds of sorts of rice in cultivation, some thrive under heavy rainfall without impounded water, and others that are grown on the banks of rivers thrive with their roots in the mud under a depth of several feet of water, and the result of intimate crossing of the plants able to hold their flowers above such a flood, is the development of a variety adapted for such conditions.

The (II.) degree of crossing occurs when a distinction of constant occurrence exists, such as a difference in form of leaf, or length of fibre in cotton, height in growth of rice, or colour of seed in grain. It is in this type of crossing that the hybridist finds his most useful effects, and the "cross-bred" result of this union, aberrant and varying from the common type, freely unites with the (III.) degree of affinity, in which the parent plants are distinguishable from each other by several distinct characters which a large series of specimens from widely distant habitats do not show intermixture into, or interchange of character with each other, and, therefore, are what is usually accepted as distinct species. The term hybrid is by some confined to this group, and the distinction is convenient; but as the limits of the abstract idea represented by the term species is largely a matter of personal opinion, the line of demarcation between cross-bred and hybrid plants is faint. The effect of breeding between distinct species of plants is sometimes sterility, but in many instances abundant seed and extreme variability is the result; then, the hybridist having grown his seedlings perhaps for several years, and selected the small percentage which suit his purpose, treats the remainder as common produce.

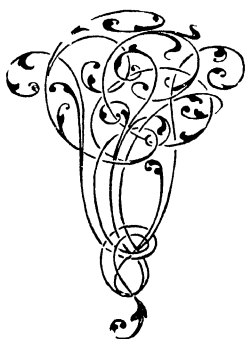
In the artificial application of pollen, it is sometimes necessary to cut open the flower just before full maturity, and emasculate the female parent by removing the unopened anthers, and to cover the flower with mosquito netting to prevent indiscriminate pollination. These precautions may be safely neglected in many plants which may be observed not to produce

seed without artificial pollination. When ready for pollination, the stigma is viscid, and a gentle touch is sufficient to attach the pollen, but to find the mature stage vigilance is necessary; sometimes it lasts a few hours, in other instances a few days. If the stigma be immature, the pollen generally may be kept under a bell glass a few days; but instances are known of its being effectively used after a long voyage, and the pollen of the date is held over in a dry state from one year to another in provision against scarcity. A camel-hair pencil or a soft feather may be used to apply the pollen; then the flower should be labelled with a number referring to a record of full particulars. In India, the Guava is a specially hopeful subject for the hybridist, the object being to secure reduction of seeds, increase in size, and improvement in flavour. The improved seedling may be grafted to roots of the common sort, so as to avoid the crop of suckers that is produced when the stem is used to graft on. The mango crosses with too much facility, and careful netting of the blossom is required to secure seed of any value. The banana could be improved by crossing the dwarf Chinese sort with the *son-kale*, so as to reduce the height of the latter, and render its cultivation more profitable; varieties of the strawberry may be raised and adapted to the local climate at our hill stations; and superior potatoes, adapted for local climatic conditions, are probable results of value.

Cultivate the best sorts procurable, and while the flowers are nearly ready to unfold, open gently and remove the anthers; cover the flowers with mosquito netting, and wait one or two days, until the stigma becomes viscid, then apply the pollen from one good sort to the stigma of another, and cover again. Some hybridists dispense with covering potato flowers. When seed has ripened, store it separately and sow in due season. Store the produce with care, and plant each tuber separately, giving ample space and high culture.

Label each with a number, and note several times during the season the character it develops, and especially when the tubers have ripened. Many will be found in no way superior to the common stock, and may be placed together. A few will show desirable qualities, and may be increased with care.

Some potatoes raised in this manner have recently been sold at a very high price; more than 10 rupees for each tuber having been obtained in several instances. Resistance to disease is one of the highest qualities of any sort of potato; regularity of shape, and shallow eyes that are easily cleaned, an attractive, floury appearance when cooked, is valued in some; and a waxy, firm consistence is valued for other purposes.



THE COMPOSITION OF PLANTS.

THE chemical composition of plants and soils illustrates to some extent the effects of manures, and is worthy of careful study. The variation in the composition of plants is considerable, and of many garden plants, has not been worked out; but the following statement of the composition of five tons of meadow grass, given by Warrington in his valuable text-book, the *Chemistry of the Farm*, may be accepted as fairly typical of garden produce in a fresh green state, such as culinary vegetables:—

Water,	-	-	-	-	-	-	-	-	8,378 lbs.
Carbon,	-	-	-	1,315	lbs.	}	Combustible, 2,613 „		
Hydrogen,	-	-	-	144	„				
Nitrogen,	-	-	-	49	„				
Oxygen and sulphur,	-	-	-	1,105	„				
Potash,	-	-	-	56.3	„	}	Ash, - - - 209 „		
Soda,	-	-	-	11.9	„				
Lime,	-	-	-	28.1	„				
Magnesia,	-	-	-	10.1	„				
Oxide of iron,	-	-	-	.9	„				
Phosphoric acid,	-	-	-	12.7	„				
Sulphuric acid,	-	-	-	10.8	„				
Chlorine,	-	-	-	16.2	„	}			
Silica,	-	-	-	57.2	„				
Sand, etc.,	-	-	-	4.5	„				
									<u>11,200 lbs.</u>

The percentage composition is probably more easy for the mind to grasp; it will be found to contain water, 78.4; combustible matter, 23.3; and ash, 1.8.

OXYGEN and HYDROGEN exist in the plant chiefly as the compound water, forming by far the largest constituent of the growing cells of plants.

In cabbage	-	-	it forms about 85	per cent.
In potatoes	-	-	"	" 75 "
In freshly-cut timber			"	" 50 "
In dry seeds, such as				
peas and wheat,			"	" 14 "
In oil-seeds	-	-	"	" 7 "

As shown above, the ash constituents of esculent vegetables amount to less than 2 per cent. of the fresh vegetable; the timber of free-growing trees contains 0·2 to 0·4 in 100 of dry matter; and in seeds, free from husk, the proportion of ash is generally from 2 to 5 per cent. of the dry matter.

The ash of old fallen leaves amounts to from 10 to 25 per cent. of the dry matter.

HOW TO DRY SPECIMENS OF PLANTS.

Specimens may be dried by pressure between sheets of absorbent paper, frequently changed. A specimen should have root, stem, leaf, flower, and fruit, if practicable.



CLASSIFICATION OF PLANTS.

PLANTS are arranged by botanists in two great divisions called sub-kingdoms; one (*Phanerogamia*¹) includes all plants commonly known as flowering plants, in which the sexual arrangement is apparent, including cypress, pine, and casuarina trees, and grasses that have minute flowers, or in which the flowers have not bright colours. The other class (*Cryptogamia*²) includes those in which the sexual arrangement was hidden from the early botanists, viz., ferns, mosses, mushrooms, seaweeds, and other allied plants.

Phanerogamia is divided into two classes. Plants of one class are called *Dicotyledons*,³ from the presence in the seed of generally two seed leaves, as in the pea, the castor-oil seed, or cotton seed. Examples—mango, orange, gauva, apple, tobacco. These plants have the veins of the leaves forming an irregular network, so that if a leaf be torn the edge is irregular. The flowers have the various whorls of organs generally in fours or fives; the wood is formed in narrow plates radiating from a central pith, and increasing chiefly by additions formed in the cambium between the wood and the bark. This may be seen easily by cutting across the stem of *Tondli*, *Coccinea indica*, or *Bhokur*, *Cordia latifolia*, and with the aid of a lens it is apparent in a great number of trees with net-veined leaves, and should be compared with the end of the sugarcane or bamboo, which are termed *Monocotyledons*, from the presence of one leaf only in the seed. The leaves of this class have the veins running parallel, as may be easily seen in a banana leaf, sugarcane, or any other grass. The parts of the flowers are in threes—for this character examine *Gulchuboo* (*Polianthes tuberosa*), or any of the plants

¹ *Phaneros*, visible; *gamos*, sexual union.

² *Kruptos*, hidden.

³ *Di*, two; *kotyledons*, hollow cups = seed leaves.

usually called lilies—and the wood is formed in wire-like bundles, which soon discontinue to grow in thickness. These bundles are easily distinguished in the stem of the cocoanut or *mhad*, in the sugarcane, and the bamboo. As these divisions are natural groups in which the individual members resemble each other in many points, yet differ in some respects, no single character or mark can be given by which they can be absolutely distinguished. Examples of *Monocotyledons*—cocoanut, grasses, pepper, ginger, orchids, aroids.

In many *Dicotyledons* one of the floral envelopes is suppressed, the calyx only being left to enclose the essential organs. In this case it is often coloured, and resembles the ordinary corolla (*petaloid*). Example—*Gulabas* (*Mirabilis jalapa*). The suppression of one of the floral envelopes is made use of for dividing the large class of *Dicotyledons* into two convenient groups, one called *Monochlamydeae*,¹ in which the flower has only one covering, often minute, sometimes wanting, and the other *Dichlamydeae*,² in which the two coverings are generally developed. *Dichlamydeae* is a large sub-class, and is again divided into groups, in which the flowers have the petals free, as in the poppy or *peela dhatura* (*Polypetalae*³), or joined, as in *sagurgota* or *bowrie* (*Gamopetalae*⁴).

¹ *Monos*, one; *chlamus*, a cloak. ² *Dis*, twice. ³ *Poly*, many; *petalon*, a leaf.

⁴ *Gamos*, marriage, union; *petalon*, a leaf.



NOTES ON GARDEN PLANTS SUITABLE FOR HOT CLIMATES.

ARRANGED IN FAMILIES.

FAMILIES, or Natural Orders of Plants, are groups which have much in common in the structure of the flower and fruit, the arrangement of the leaves, the useful or the deleterious properties; and usually a similarity of features which are important in cultivation, such as the period of vitality of the seed, facility in cross-breeding, grafting, transplanting, or special soil or climate necessary for well-being.

RANUNCULACEÆ,¹ *The Crowfoot Family.*

This family generally affects a temperate climate, but a few examples are found in the gardens of hot climates. As a rule, they are long in germinating, and enjoy the mountain tops and abundant water during the growing season.

ADONIS ÆSTIVALIS or ADONIS AUTUMNALIS²—*Goutte-de-sang*—Pheasant's Eye.—An erect annual, 1 to 2 feet in height, with scarlet flowers, is at home in West Temperate Himalaya, and may be raised from seed sown during June and January.

ANEMONE RIVULARIS,³ with white or bluish flowers, 1 to 1½ inches diameter, is at home in West Himalaya at

¹ *Ranunculaceæ* = *Ranunculus*, a little frog, applied by Pliny to species which abound in wet places; + *aceæ*, a new Latin suffix applied to a family of plants.

² *Adonis*, mythical; fabled to have sprung from the blood of Adonis; *æstivalis*, pertaining to the summer; *autumnalis*, pertaining to the autumn.

³ *Anemone*, a wind flower; *rivularis*, pertaining to a stream.

5,000 feet altitude. *Anemone fulgens* and other garden sorts may easily be cultivated at similar altitude.

AQUILEGIA HYBRIDS¹—*Columbine*.—The original species abound in Temperate Himalaya, and the garden sorts may be cultivated with little difficulty at 4,000 to 7,000 feet altitude if sown when the monsoon is well advanced.

CLEMATIS are climbing shrubs, with opposite leaves, a bright coloured calyx, and no corolla.

Hybrid varieties, with blue, white, and crimson flowers, are frequently brought from temperate countries. The Indian species are all handsome plants, but the following is the best. It may often be seen growing in clumps of prickly-pear in the Deccan, and the species generally are believed by the people to be valuable against many diseases. The cultivation required is moderately rich soil with perfect drainage, abundant water while growing fast— which is generally during our hottest months— and very little after the growth is ripened. Propagate by inarching on to the root of an indigenous sort, of which one of the best is—

CLEMATIS TRILOBA²—*Mor-Yale* of the Deccan— with simple or three-lobed leaves and sweet-smelling white flowers 1 inch in diameter. Suitable for covering an arch where the flowers are within reach of the hand. Propagated by seeds and layering. A charming climber, flowering about September. Cross breeds between this species and the large flowered varieties would be valuable.

DELPHINIUM BRUNONIANUM³—*Samp-phuli* of the Panjab-Himalaya—is a pretty blue-flowered herb, growing at high altitudes. It is musk-scented, and the juice is used to destroy ticks.

¹ *Aquilegia*, from *aquila*, an eagle, from the claws of the flower.

² *Clematis*, from *kleme*, a vine branch; *triloba*, three-lobed.

³ *Delphinium*, the Greek name used by Dioscorides; *Brunonianum*, Brown's.

DELPHINIUM DASYCAULON¹—*Ghat Larkspur*—is a very handsome herbaceous plant, with bright blue flowers in loose racemes, the calyx coloured blue and forming a spur. It is a rare plant, occurring on the hills just east of the line of Western Ghats, near Kadkala, and also near Junnir, and thrives on a deep, stony loam with frequent watering during the rainy season only.

DELPHINIUM CÆRULEUM—*Dakhungu*.—An attractive Himalayan sort; also—

LARKSPUR—*Delphinium ajacis*.²—An annual with much divided alternate leaves and showy racemes of blue flowers. If sown in October, Larkspur makes a showy bed during January to April. A deep, friable soil and water sufficient to maintain moisture is required. It is advisable to sow where the plants are wanted to bloom, and thin out instead of transplanting, and to keep on the northern face of a house above 2,000 feet altitude.

NIGELLA³ Varieties.—*Love in a Mist* is an annual having blue flowers and much divided foliage. If sown at 4,000 feet altitude, in the latitude of Bombay or lower, northward, with a deeply tilled rich border and thinned as growth advances, flowers appear during the cold season.

RANUNCULUS ASIATICA.⁴—Roots of this pretty plant are often imported during the cold season, and blossom at the beginning of the hot weather, but give way to the heat as the season advances.

¹ *Dasycaulon*, hairy stem.

² *Ajacis*—the specific name was given from the supposition that the letters A, J, A were to be seen on the lines of the petals.

³ *Nigella*, diminutive of black.

⁴ *Asiatica*, from Asia.

DILLENiaceÆ,¹ *The Karmal Family.*

A small group of trees or shrubs, sometimes climbing. The garden members are trees with grand, alternate, exstipulate leaves, having conspicuous lateral parallel nerves and fruit enclosed in five thickened sepals.

DILLENIA INDICA—*Mota Karmal, Uva Chitta, Chalta*, of Assam valley—is a very beautiful tree of a spreading habit, with bright green leaves having conspicuous lateral nerves ending in a tooth at the margin, and very fragrant pure white flowers, 9 inches diameter, succeeded by fruit enclosed in five thickened persistent sepals forming a ball the size of the fist. The sepals have an agreeable acidity and are used in curries. This elegant tree thrives in moist climates, such as that of the Dang country, the Circar mountains, and in the Botanical Garden, Calcutta. In dry districts it thrives in sheltered positions in deep soil, and is well worthy of care for its magnificent flowers. It is propagated by seed.

DILLENIA PENTAGYNA²—*Karmal, Rowadan*—is well worth attention for its magnificent foliage. In the Dang forests of Guzerat and in the Assam valley its leaves, on young trees growing in rich soil, shaded, attain 4 feet in length by 1 foot in breadth; they are richly copper-coloured and hairy while young, and, arranged in a dense tuft crowning a simple stem, make a grand impression. Its yellow flowers, about 1 inch diameter, appear in the hot season, and are succeeded by fruit $\frac{1}{2}$ inch in diameter.

¹ *Dilleniaceæ*, from the genus *Dillenia*, named in honour of John James Dillenius, Professor of Botany at Oxford; died 1747.

² *Pentagyna*, having five divisions in the ovary.

MAGNOLIACEÆ,¹ *The Magnolia Family.*

A small group of trees and shrubs much prized for elegant and sweet flowers often of large size. The species affect the cool districts in tropical climates, and warm districts in temperate climates, and are propagated by seed or layers, and the varieties by grafting.

MAGNOLIA GRANDIFLORA.²—A grand tree of the Southern United States, with broad entire shining leaves and bearing in May, very large sweet white flowers. At the latitude of Bombay, it thrives at 2,000 ft. altitude, but better as far north as Lahore in a thin shade conservatory, if planted in a deep soil thoroughly drained, and watered occasionally during dry weather. It is increased by seeds, which ripen at Lahore, and by *guti*.

MAGNOLIA CAMPBELLII³—*Lal-Champ, Sigumgrip, Pendar*.—A grand flowering deciduous tree of the Sikkim Himalaya at 8,000 to 9,000 altitude, has very large flowers, deep rosy on the outer side, pale rose within. It is fit for cultivation at 7,000 feet altitude, and is propagated by seed which is very short lived.

MAGNOLIA YULAN, a Chinese species, grows with the same treatment as is advised for *Magnolia grandiflora*, but its foliage is not as handsome in this climate. It is propagated by layering.

MAGNOLIA PUMILA.⁴—A small shrub with oblong leaves; often disfigured by decayed portions and very sweet-scented globular white flowers. It thrives with slight shade, and a free admixture of potsherds in the soil.

¹ *Magnoliaceæ*, from the genus *Magnolia*, named in honour of Pierre Magnol, Prefect of the Botanical Garden at Montpellier; died 1715.

² *Grandiflora*, large flowered.

³ *Campbellii*, from Dr. Campbell, resident at Darjeeling.

⁴ *Pumila*, from *pumilio*, a dwarf.

MICHELIA CHAMPACA¹—*Sone Chapa, Chapaka, Pivala-Chápha*.—A tree resembling the mango in habit and the shape of its leaves, with foliage of a dull green hue and sweet-scented yellow flowers, produced in great numbers during the rainy and cold seasons, from about the third year of the growth of the tree, if well developed, succeeded by one-celled fruits, which opens and permits the seeds to hang out by long funicular cords. This tree thrives throughout India, especially with 1,000 to 4,000 feet altitude, in southern districts, in ordinary garden soil of considerable depth, watered occasionally. It is propagated by seed, which is procurable at Panchgani, Abu, stations of 4,000 feet altitude. White-flowered varieties are in cultivation, which are propagated by grafting to seedling plants. Its valuable medicinal properties are detailed in *Pharmacographia Ind.*, I., 42.

ANONACEÆ,² *The Custard Apple Family.*

This group of plants are trees or shrubs, sometimes climbing, with alternate exstipulate leaves and flowers with fleshy petals, often of a pale-yellow colour, and having an agreeable perfume. A deep stony soil is generally suitable, but alluvial soil produces good specimens, and fresh seeds are necessary for propagation.

ANONA SQUAMOSA³—*Custard Apple, Ata, Sitafal*.—A deep stony soil with perfect drainage, enriched with decayed town sweepings, are the conditions enjoyed by this hardy fruit tree. In a soil of this description, pits, 2 feet deep and 10 feet apart each way, should be dug and filled with one-half surface soil and one-half decayed sweepings, well mixed, and heaped up 6 inches to allow

¹ *Michelia*, after Peitro Antonio Michele, a celebrated Florentine botanist, 1679-1737.

² *Anonaceæ*, from the typical genus *Anona*, probably from *Noona*, the Bengalee name of *Anona reticulata*.

³ *Squamosa*, scaly.

for settling in the holes. Several fresh seeds should be sown in each pit, and the intervening space cultivated with potatoes, or any other suitable crop. When the seedlings have started well, all but one or two should be pulled out, and superior varieties grafted below ground-level. Superior varieties of this fruit are really delicious, and even the common varieties bear useful fruit, procurable in seasons of drought, when little else is available. After the young fruit has appeared, watering with weak liquid manure occasionally and fresh water sufficient to keep the soil moist, is desirable until the fruit be gathered, then pruning off weakly branches and rest by drought is desirable.

A good specimen of the Custard Apple grown under irrigation in garden of Collector's house, Bellary. *Weight*--A little over 1 lb. 7½ ounces, with stalk cut flush. Stem, pulled out, weighs a little over ¼ ounce. Fruit contains 64 seeds, weighing 1 ounce exactly. Thus weight of fruit, without stalk, stem, or seeds 1 lb. 6 oz. Ripe on 17th January, 1896. Very creamy and delicious. --H. Tremenhœre.

Superior varieties are propagated by grafting, below ground-level, cuttings on a hot-bed or *guti* layers (see page 32); the common sorts, by seed. The tree makes a hardy fence, and the seeds, powdered, are used as an insecticide.

ANONA CHERIMOLIA--*Cherimolier du Perou*—much resembles the Custard Apple, and is a very superior fruit, the size of the fist, and having the flavour of strawberries and pineapple. Its cultivation is the same as that of the Custard Apple.

ANONA RETICULATA¹—*Bull's Heart, Ramphul, Noona, Cachiman, Coeur-de-boeuf, Carossol reticulé*—with large, fleshy, smooth, heart-shaped fruit, and ANONA MURICATA—the *Sour Sop, Grand Carossal*—resemble a large custard apple, with soft thorn-like

¹ *Reticulata*, netted, referring to the surface of the fruit.

points to each of the pips. Both of the above are raised from fresh seeds sown where the tree is wanted. The fruit is nutritious, but insipid.

POLYALTHIA LONGIFOLIA¹—*Asaphula*, *Asok*, *Rat*, *Devadari*—is an elegant tree, with lance-shaped shining leaves, wavy at the edges, and greenish star-like flowers appearing at the beginning of the rainy season. It enjoys a deep stony soil, especially the *débris* of a building, and looks well planted in streets. As this tree does not transplant well, pits, three feet deep, should be prepared, filled with loose open soil, enriched with town sweepings, and several *quite fresh* seeds planted; when so treated, it shoots up rapidly, and needs little attention after the first year or two. The seed ripens about the end of July.

As a high fence or screen, this tree has been used with success on a rich alluvial soil. To produce a screen of this kind, a trench may be dug two feet in depth; the upper one foot of soil being placed on one side and mixed with a liberal quantity of town sweepings; may be refilled, and a few seeds planted in groups one foot apart, to be gradually thinned out to three feet apart. The soil from the lower stratum may be spread on the surface at the sides of the trench, to benefit by exposure to air, before being required for the nourishment of young trees.

ARTABOTRYS ODORATISSIMUS²—*Hara-Champa*—is a climbing shrub, with bright green leaves and thick fleshy flowers, green in colour until ripe, when they become yellow. This climber can easily be trained in an umbrella-like form, and enjoys a full supply of lime rubbish and other open material in the soil. Propagated by layering and by seeds.

¹ *Polyalthia*—*Poly*, much; *althecis*, healthy; alluding to supposed properties of the tree. *Longifolia*, having long leaves.

² *Artabotrys*—*Artao*, to suspend; *botrys*, a bunch. The peduncle has a curious hook, which enables it to suspend the bunch of fruit. *Odoratissimus*, most odorous.

UNONA DISCOLOR,¹ a small spreading shrub, with pale-yellow odorous flowers. Propagated by layers.

UNONA ODORATA—*Cananga*.—A small tree of upright growth, having alternate ovate-lanceolate entire-undulated leaves, and bearing flowers in stalked groups of three, the calyx having three triangular obtuse divisions united at the base, and the corolla of three linear divisions; calyx and corolla ultimately yellow and odorous. This small tree thrives in gardens throughout India if sheltered from hot wind and irrigated, and without excessive rainfall: it is increased by seeds.

MENISPERMACEÆ,² *The Moonseed Family*,

Is a small group of interesting medicinal shrubs, and not of great importance in gardens, but—

TINOSPORA CORDIFOLIA³—*Guwail, Gulancha, Tippatige, Gado, Rasa-Kindu* (Ceylon), *Amrita-balli* is a valuable medicinal plant, having tonic, antiperiodic, and diuretic properties. It is a twining shrub with scabrous corky bark and broad cordate leaves. This plant is so retentive of life that if a branch be thrown on to a fence during the rainy season, roots will be produced which will reach the ground. The male and female flowers are on separate plants, *dioecious*, and the stem is useful in teaching botany from the large size of its parts, making its structure clearly apparent.

ANAMIRTA COCCULUS⁴ is a shrub producing trailing branches bearing alternate smooth, deep-green, heart-shaped leaves 8 by 6 inches, attached by strong stalks nearly of the length of the leaves. The beauty of the

¹ *Unona*, altered from *Anona*. *Discolor*, parti-coloured.

² *Menispermaceæ*—*Mene*, the moon, and *sperma*, a seed, alluding to the half-moon-shaped seed which some of the species produce.

³ *Tinospora*, wormseed; *cordifolia*, having heart-shaped leaves.

⁴ *Anamirta* (probably from the Sanskrit word for unfriendly, the popular character of the plant); *cocculus*, from the resemblance in colour of the berries to the *coccus*, cochineal insect.

foliage is sufficient to make this an attractive plant, but its charm is enhanced by long pendulous racemes of fruit, the size of a large pea, white during December, becoming red and ultimately black as it ripens. *Anamirta* is adapted for a rocky bank in a moist climate, and may be propagated by seed, which is known in commerce as *cocculus indicus*.

CISSAMPELOS PEREIRA¹—*Pahadvel, Tikri, Karandhis, Ponmututai*.—A climbing shrub which appears in garden fences in moist districts, and is valued as a bitter tonic and diuretic. The leaves have the stalk fixed near the centre (peltate), and the flowers are small, yellow, and unisexual.

BERBERIDEÆ, *The Barberry Family.*

A group of shrubby, glabrous plants abundant on our mountains above 5,000 feet altitude, and in such places are useful as fences from the spines which arm the leaves.

BERBERIS WALLICHIANA²—*Dar-halad, Raswanti, Raswal*.—forms a very pretty bush with 3 to 5-fold strong spinous shining leaves—spinous on the margin and abundant small pure yellow flowers. Native on Parasnath and Himalaya, it thrives in a cool sheltered position in the plains, and is interesting as the source of berberine, an alkaloid having important medicinal properties, obtained from the stems.

HOLBELLIA LATIFOLIA.³—A climbing shrub from altitude 3,000 to 6,000 feet in Himalaya, bearing 3 to 9 foliolate leaves, and short racemes of sweet smelling monœcious bell-shaped purple or greenish flowers, having 6 sepals, 6 petals, 6 stamens, and numerous seeds.

¹ *Cissampelos*, so called because it climbs like ivy, and has fruit like the grape vine.

² *Barberis*, derivation obscure.

³ *Holbøllia*, after F. L. Holbøl, Superintendent, Botanical Gardens, Copenhagen; *latifolia*, broad leaved.

NYMPHÆACEÆ, *The Water Lilies.*

This charming group of plants is of easy culture and well repays attention. A tank with varying depths of water, arranged so that during the rainy season it may remain full, and during the remainder of the year one part may contain water, and another remain dry, is desirable for growing a large collection, because some require water continuously, and others thrive better when dried up during the dry season of the year. Propagation is generally effected by seed, and tubers. The soil must be freely manured, unless it receives the washings from fields. For manuring water plants, old well decayed manure may be mixed with the soil, or dissolved bones and saltpetre may be thrown into the water in small quantities at a time. Weeding must be attended to, because water-weeds grow more rapidly than land weeds.

VICTORIA REGIA¹—*Irupe*.—This is fitly named the “Queen of Water Lilies.” It is an extremely large and interesting water lily (species of *Kummel*), a native of the Amazon River. Its circular floating leaves are 5 to 8 feet in width, with the edge turned up a few inches. This great expanse of leaf is protected on the lower side by spines and supported by a system of ribs, which form strong cells, increasing the buoyancy of the leaf to such an extent that in several experiments it has been found to bear the weight of a man. The flowers of this grand plant are proportionate to the size of the leaf, and have a sweet perfume, which scents the breeze to a considerable distance.

A pond for the Victoria should be 30 feet in width, and in length twice or three times as much, with a depth of 4 feet in the centre and not less than 1 foot at the sides. It should be sheltered from wind, as storms raise and invert the leaves, and may be provided with

¹ *Victoria*, named after the late Queen of the British Isles and Empress of India; it is now called *Nymphæa Victoria*. *Regia*, royal.

a constant supply of water, sufficient to permit a slight overflow and keep the surface free from scum. A constant supply is desirable for elegance, but good plants have been reared from an intermittent supply from an irrigation channel which brought in mud and discoloured the water. It is desirable to prepare soil six months in advance of planting time by placing in alternate thin layers—for each *Victoria* plant to be cultivated—a cartload of sandy loam from a river bank and an equal quantity of fresh manure. The heap being kept moist and turned over several times, will be in excellent condition when the planting season arrives.

During March to May, several seeds being planted in a basket of rich soil, it should be placed in a larger basket, so that when placed in water the edge of the outer basket may remain above the surface and exclude the larger depredators.¹ The seed is sometimes long in germinating, but if seed which shows a white protuberance be planted, a few days will be sufficient to produce young plants. Meanwhile the soil may be placed in the principal tank in a heap sufficient to leave about one foot of water above the centre of the young plant. Growth proceeds rapidly, the soil sinks, and the water may be raised so that ultimately three feet of water remains over the centre of the plant. If well developed, the plant begins to blossom when about three or four months old, and produces a fresh flower at intervals of three to five days during the hot part of the year. In a suitable position, the *Victoria* sows itself so that thinning out the plants and top dressing those that are retained with a rich mixture of soil and manure is sufficient to secure ample development. In a warm, moist climate, the plant lives several years, but it becomes weakly and in cold weather it is killed;

¹ The *Victoria*, while young, is sometimes attacked by minute *algæ*, which cover the plantlet completely and prevent growth. Against this, copper sulphate, 1 part to 100,000 parts of water, is recommended. It is said also to destroy the germs of cholera and typhoid in three to four hours.

therefore it is advisable to treat the *Victoria* as an annual.

Should sufficient time for the preparation of a very rich soil not be available, ordinary soil may be used, and 2 lbs. of saltpetre—either of the Chilian or the Indian form—may be thrown into the water daily, and occasionally a small quantity of bone-ash which has been dissolved with diluted sulphuric acid, and subsequently a quantity of fresh bone-ash thoroughly mixed with the dissolved ash so as to ensure the absence of free sulphuric acid. While treating the plant to such soluble manure, the overflow should be restricted.

Seed of the *Victoria* should be kept in fresh water, protected from rats. The opening flower may be cut off and placed in a water vase for the decoration of apartments; the perfume while the flower is opening is delicious in an open place, but rather too strong in a small apartment. Three plants at least are desirable to ensure fresh flowers daily.

Victoria regia Trickeri is a variety having a green undersurface, and the margin upstanding 5 inches.

EURYALE FEROX¹—*Jewar, Makhana*.—A perennial water plant, native of East Bengal and Kashmir, having leaves about 2 feet diameter, and purple flowers 1 inch across. It is armed with strong spines and, although attractive at first, is apt to become very undesirable in ponds, as it did at Bombay in 1867, where it cost much to eradicate.

NELUMBIUM SPECIOSUM² (The Lotus) *Kamal, Kadum, Padma*.—In tanks with a muddy body, little overflow, and the loss by evaporation made up by supplies of fresh unfiltered water, this grand water-lily is of easy culture. The colour of the flower in Western India is generally bright rosy, and in Coromandel dis-

¹ *Euryale*, the name of one of the mythological gorgons with thorny hair, in allusion to the spine; *ferox*, fierce.

² *Nelumbium*, from *nelumbo*, the name used in Ceylon; *speciosum*, showy.

tricts pure white is to be found. Propagation is most easily effected by seed, which should not be more than a month out of water. Tubers which form on the creeping stem may also be used for propagation.

The hybridist has recently been at work on this genus, and the result is many varieties having large brilliant-coloured flowers very suitable for the garden.

NYMPHÆA BLANDA.¹ A South American scented night-flowering water lily. Grows well at Madras if partially shaded, but is unable to bear full exposure.

NYMPHÆA LOTUS—*Kamal* (sacred to Latisimi, the goddess of wealth and prosperity) has flowers varying from pure white to bright red, without appendages on the anthers. This species grows freely in tanks of sweet water, either when the water is permanent or if allowed to dry up during the hot season. It is propagated by seeds or, preferably, by tubers found in the mud of water-holes where the plants have been growing. To transplant this beautiful water-lily to the garden, it is advisable to mark the spot they are seen growing in and dig up the tubers during the following hot season. Water lilies transplanted while in water seldom thrive.

NYMPHÆA STELLATA *Uplia Kamal*—has most frequently blue flowers, but a variety of shades are to be found. Its distinguishing character is the long appendages to the anthers, which are wanting in *Nymphaea Lotus*. Their garden treatment is exactly similar.

NYMPHÆA STELLATA ZANZIBARENSIS is a large blue flowered sort.

PAPAVERACEÆ, The Poppy Family.

The plants of this family are herbs with alternate, usually sessile, leaves, showy flowers, and oily seeds, borne on the walls, or on plates extending inwards from

¹ *Nymphaea*, from *nymphæ*, a water nymph.

the walls of the capsule. The roots are generally strong and deep-searching, with few fibres, and the plants do not bear transplanting well. Propagation is effected by seed.

PAPAYER¹ ORIENTALE—the *Garden Poppy*, *Lala*.—A showy herb, with much-divided leaves, and large scarlet flowers having a dark spot at the base of each



SUTTON'S DOUBLE GIANT POPPY.

(This illustration of the double poppy is produced by favour of
Sutton & Sons, Reading.)

petal. It enjoys a deep sandy soil, manured with dung or leaf mould. The seed should be sown during October–November, where the plants are wanted to bloom, and thinned out to 12 inches apart. A large bed of this flower is a most satisfactory possession, obtainable for comparatively little labour. The improved varieties with double flowers, as illustrated, may be sown in lines

¹ *Papaver*, the old Latin name used by Pliny.

18 inches apart, in a soil that has been deeply dug and heavily manured three months in advance. To thin out the plants in the line, and keep the intervening soil thoroughly stirred and watered sufficient to maintain a moist state, is all the necessary culture. To rear the plant in pots and plant-out 6 feet or more apart, with *Coreopsis* or *Verbena*, requires more skill, but the result is worth the effort. The difficulty is to avoid unduly checking the growth of the poppy. The dark-coloured poppies may be observed to emit flashes of light on warm evenings.

PAPAVER BRACTEATUM¹ is a variety of the above, with bracts at the base of the flower largely developed, and is treated similarly.

PAPAVER HOOKERI² is a large species, forming a bushy herb 3 to 4 feet in height, with large flowers varying from rose to deep scarlet. In treatment it is similar to the other species, but must be thinned out more, or sown thinly in pots, separated while young, and, when well established, planted 3 to 4 feet apart.

THE OPIUM POPPY *Papaver somniferum*,³ *Afim-ke-jhar*, *Khus-Khus*, *Post*.—A large poppy, generally white, but to be found of a mixture of rose, lilac, or violet and white. The source of the drug opium, which is the dried sap obtained by scratching the immature capsule with little knives, that are fastened together in fours. A rich deep soil, as open and friable as possible, is desirable. The seed should be sown where the plants are wanted to bloom, and the plants freely thinned. They appear to advantage in masses.

ARGEMONE⁴ MEXICANA—*Peela Dhatura*—is now too common for the garden.

¹ *Bracteatum*, having small modified leaves beneath the flower.

² *Hookeri*, after Sir Joseph Hooker.

³ *Somniferum*, sleep-producing.

⁴ *Argemone*—*Argema*, cataract of the eye.

ESCHOLTZIA¹ CALIFORNICA.—An annual with large, bright yellow flowers and much-divided leaves. Sow in sandy loam, about September or October, on the spot where the plants are wanted to bloom.

ROMNEYA COULTERII, from California, is a poppy with white flowers which thrives at 3,000 feet altitude and upwards.

BOCCONIA CORDATA.²—A handsome foliage plant for a light conservatory. The leaves are alternate stalked, large, cordate-lobed, and of a pale green colour. The flowers are small, but are produced in large terminal racemes. Propagate by seeds.

DISCENTRA SPECTABILIS³ *the Chinese-lantern plant*—is a very elegant herb, highly valued as an early Spring flower in temperate climates. It will grow at hill-stations if well-established plants, in a resting state, are imported, and might be hybridised with *Discentra Roylei*, or some other indigenous species.

CRUCIFERÆ, *the Mustard and Cabbage Family*,

Is so called from the cross-like arrangement of the four petals, and is a very important group from the number of wholesome esculents it includes. Of these, cauliflower, cabbage, and radish are familiar examples. Although much cultivated in India, the family generally affect temperate regions, and is valued for the nutritive and antiscorbutic properties of many of its members.

This family, as a rule, needs a very rich friable soil, with abundant manure, and is indifferent to a considerable quantity of salt in the soil. Being temperate-climate plants, nearly all of them thrive better if sown when the

¹ *Escholtzia*, after Escholtz, a celebrated Naturalist (1793 1831).

² *Bocconia*, after Paolo Bocconi, M.D., a Sicilian botanist. *Cordata*, heart-shaped.

³ *Discentra*—*Dis*, twice; *kentron*, a spur. *Spectabilis*, remarkable.

rainy season is nearly over, but the season may be prolonged till May by planting on the northern side of a high tree, where abundant light accompanies partial shade at midday. Seed is the only means of propagation generally used, but valuable varieties are sometimes increased by cuttings and division of the root-stock. In this family, special attention should be given to the system of defeating insect enemies given on page 80.

ALYSSUM SAXATILE,¹ with silvery-gray foliage and yellow flowers, and ALYSSUM MARATIMA—*Sweet Alyssum*—with white, honey-scented flowers, grow nicely, if sown after the rainy season, at 3,000–7,000 feet altitude, with protection from high sun and drought.

ARABIS ALPINA²—*the Rock Cress*.—A pretty herb with flowers: is at home in West Himalaya, about 5,000–7,000 feet altitude, and may be cultivated much lower.

AUBRETIA DELTOIDEA³—varieties, *Graeca* and *Violacea*.—Dwarf herbs, with purple or violet-purple flowers, which thrive about 3,000 feet altitude, if sown in August–September.

BORECOLE, or KALE, is, like the cabbage, a variety of *Brassica oleracea*, but differs in retaining a natural development of the leaves, and has greater power to resist cold, and the leaves are scarcely esculent until frost-bitten; therefore its cultivation in India is not profitable, except at high altitudes.

BROCCOLI is a variety of cabbage having a fleshy, edible head like cauliflower, but thriving with much less heat than cauliflower requires. Its cultivation is the same as that of cauliflower, and it is seldom grown where that delicate vegetable thrives under the same conditions. The seed is very much cheaper than that of cauliflower.

¹ *Alyssum*, a plant used to check hiccough. *Saxatile*, frequenting rocks.

² *Arabis*, from Arabia. *Alpina*, alpine.

³ *Aubretia Deltoidea*, having three angles.

BRUSSELS SPROUT.—A variety of cabbage with a long stem crowned by a small head of blistered leaves. From the stem small shoots (sprouts) appear, which are a delicate vegetable. The cultivation is exactly as detailed for cabbage, but the sprouts should be gathered and used when between two and three inches long.

CABBAGE—*Cobi* (*Brassica oleracea* variety).¹—Of this wholesome vegetable there are several well-marked varieties, distinguished by the size, shape, and colour of the conglomerated leaves, “heads.”

If the rainfall is not over 50 inches annually, the seed may be sown about the middle of August for the main crop; if sown earlier, the crop has many insect enemies to contend with, which weaken the seedlings, unless the weather proves exceptionally favourable; if the rainfall is heavy, defer sowing till the middle of September, and see that a well-drained spot is selected for the seed-bed. Make a small fresh sowing twice a month till November to prolong the season.

The seed should be sown on soil that has been well manured for the previous crop, with the addition of a small quantity of decayed manure worked into it, at the time of sowing.

Sow in lines, six inches apart, half an ounce of seed to 100 square feet, and give a thorough watering. Good seed will germinate within ten days. When the plants are well up, thin out carefully, so that there may be no crowding to make the plants weakly. When the seedlings are about four inches high, see that the soil is in a moist but not wet condition; then lift carefully, so that some soil may adhere to the roots, and transplant to the permanent quarters, which must be a first-class soil, well worked and enriched with a liberal supply of decayed cow-dung or town sweepings; poudrette is also excellent if there be no stint of water, and the drainage is good. The quantity of manure to be given depends

¹ *Brassica*, from *bræsci*, the old Saxon for cabbage; *oleracea*, herb-like.



SUTTON'S EARLY CABBAGE.

so much on local circumstances, that no distinct rule can be laid down, but there is little danger of giving this crop too much manure if it be well mixed with the soil. An average of one inch in depth of decayed cow-dung or *poudrette* is a sufficient dressing for growing cabbage and other strong growing crops with abundant irrigation. The cabbage is not a deep-rooting plant in India, therefore irrigation must be provided at short intervals—once in four days for soils of average retentive quality. While the plants are young, the irrigation should be supplemented by an evening shower from a watering-pot at least once in two days; and when well established, a soaking of liquid manure at the root once a week is desirable.

The distance apart the plants should be put in depends on the size the variety attains; 2 feet for small and $2\frac{1}{2}$ feet apart in both directions for large varieties are suitable distances.

If large, well-filled heads are expected, the hoe must be kept at work stirring and breaking the surface as often as possible—at least once in ten days is necessary—until the plants cover the ground.

The root of the cabbage being small in proportion to the leaves, and not adapted for wide foraging, a soil in the best possible condition is necessary, therefore it should not have produced a crop of any other *Cruciferae* for a year previous to the planting of cabbage.

SUTTON'S EARLY CABBAGE—*Nareli Cobi*.—An upright-growing sort, giving small early heads.

EARLY CABBAGE.—A tender white variety of medium size.

DRUMHEAD CABBAGE—*Bopali Cobi*.—A large sort giving very firm flat heads, which bear carriage well, and is a favourite with market gardeners. This variety appears to me more fit for table in hot climates than it is in England, where it is considered somewhat coarse in flavour.

RED CABBAGE—*Lal Cobi*.—A small red sort used for pickling and in French cookery. It should be sown in the beginning of the cold season, as it does not stand heat well.

Should green fly abound, page 73 will suggest a remedy.

CANDYTUFT—*Iberis umbellata*¹—is a nice-looking annual of easy culture, with purple flowers growing 8 or 10 inches high. It may be sown from July to October in a deep, loose soil, and not transplanted. Water once in three days in sufficient quantity to keep the soil moist. It thrives specially at high altitudes or in northern districts.

CANDYTUFT, SWEET *Iberis odorata*.² A pretty, dwarf-growing, white-flowered, sweet-smelling annual, which in dry districts may be sown at the beginning of July in deep, friable soil, and will flower during September; or if sown in November, will bloom in January and February.

CAULIFLOWER —*Phul Cobi* This is universally considered the most delicious of the varieties of *Brassica oleracea*. The part usually eaten is a malformation of the flower shoot, which occurs during the early part of its growth, forming a white conglomeration of imperfect buds and a few of the tender leaves surrounding the head.

Cauliflower being a delicate plant, always needs great care and attention in its cultivation, but much less care is necessary in hot countries than in Europe. The soil most suitable is a rich friable loam, such as occurs in the black soil of the Deccan, the alluvial tracts in the basin of the Ganges, or Nerbudda. Thorough working of the soil is necessary, and in cases where the market price of

¹ *Iberis*, from *Iberia*, the former name of Spain; *umbellata*, having an umbel.

² *Odorata*, sweet-scented.



SUTTON'S EARLY CAULIFLOWER.

cauliflower is usually over 4 annas per head, as is the case in many parts of Southern India, the crop is well worth extra care in the preparation of the soil. This process should be begun shortly after the rains, when the soil is easily ploughed or dug. It should then be turned up roughly to a depth of a foot or fifteen inches. A month later the clods should be broken with the mallet or clod-crusher, and the plough put through the ground a second time. When the soil has weathered a few weeks, the scarifier or cultivator should be run over it once monthly until May. At that time good cow-dung or poudrette should be spread 1 inch deep, and any close-growing crop which is not valuable, such as *Sunn*, *tag*, *chanamoo*, *Crotalaria juncea*, or other convenient Leguminosæ, should be sown thickly to keep down weeds and encourage the formation of nitric acid in the soil, which has proved to be effected to a greater extent under a crop than on bare soil. During dry weather in August the crop should be pulled up and the ground ploughed or dug, and the crop buried in the trenches to act as green manure, and the land prepared for irrigation.

The seed-bed should be prepared by thorough digging and mixing with the soil about an inch in depth of old manure. Wood ashes and decayed sweepings, having a quantity of goat or sheep dung in it, is well suited for the seed-bed at this season. Cow-dung is apt to have the larva of the dung beetle in it—a very large caterpillar, which destroys young plants by eating through the stem underground. The bed having been thoroughly watered, the seed may be sown broadcast or in lines, and covered with a quarter of an inch of fine dry sandy soil and shaded from bright sunshine. When the seedlings appear, gradually remove the shade. The most convenient form of bed is not more than 4 feet in breadth, the length being sufficient for the ground to be planted. 1 ounce of seed is sufficient for a bed of 50 square feet, which will give sufficient plants for an acre if the seed is good. Sowing should be made once in ten

days from the middle of August till the end of September. If the garden has been neglected or the district is remarkable for the quantity of grubs that yearly come out in August, spread a considerable part of the garden with a thick coating of stable litter or dry leaves, and burn it; prepare the seed-bed in the middle of the burnt space, and soak 1 pound of saltpetre in water for 100 square feet, and water the bed with it at least two weeks before sowing the seed. Should the seedling be attacked by insects, soak tomato leaves and stalks in water and use the infusion to water the plants. The seedlings having about five leaves, and the ground to plant being ready, on a cloudy day lift the seedlings gently and plant out $2\frac{1}{2}$ feet apart in both distances. If bright sunshine comes out, shade the newly moved plants, and water daily with a watering-pot for a few days, besides irrigating sufficiently to keep the soil moist. Afterwards hoeing and picking grubs and replacing losses from the seed-bed must be attended to.

The selection of sorts is a serious matter in cauliflower, because many sorts grow to leaves only in some climates, and great loss has been met with by some people in consequence of getting the wrong variety. A variety known as "Large Asiatic" has established itself in Northern India, where a good head of cauliflower is procurable in December for a small sum. This sort is perfectly reliable when properly cultivated, but its season is very short. It appears to run to seed when January comes, at whatever time it may have been sown, while imported varieties come into use from the beginning of December to the end of February, according to the date of sowing.

Among imported varieties, success will generally be met with by sowing the varieties of cauliflower called "Early," "London," and "Walchern." The "Giant" and "Mammoth" varieties advertised in seedsmen's catalogues should be grown as extras, and if one is found to suit the soil and climate of a particular station, it may be grown more extensively afterwards.



CAULIFLOWER—SUTTON'S MAGNUM BONUM.

Insect enemies are the same as the cabbage, and may be treated as detailed under that head, with special attention to the system of defeating injurious insects given at page 73.

CRESS—*Aliva*, *Halim*, *Lideli*, *Lepidium sativum*.¹

A small annual plant, cultivated as a salad. To obtain cress in good condition, it should be sown on a friable rich soil, previously watered and kept shaded, so that little watering may be necessary, and the plants grown as tender as possible. Cut with scissors near the surface of the ground; a week after sowing, it should be ready to cut, and a fresh sowing should be made every three days.

Cress is grown as a field crop in some parts of Guzerat and the Deccan for its seed, which is considered a tonic and alterative, therefore the seed is cheap in the bazaar. A very pretty way to grow this plant is this. Take a porous water goblet and smear it carefully with a mixture of soil, manure, and water, dry it to cause the mud to adhere; then moisten and sprinkle with cress seed, beating the seed into the soil gently. Fill the goblet with water and let it stand in a saucer. The water will leak through the goblet, and if kept in a diffused light, the seed germinates and forms a pretty cress bed fit to decorate a breakfast table.

KNOL-KOHL or KOHL-RABI is another variety of *Brassica oleracea*, which to a great extent replaces the turnip in hot climates, as it endures heat better than that esculent. Let the soil be enriched with manure, as detailed for cabbage, and in the Deccan sow any time from May till January; the early-sown crop should be shaded slightly till the rain sets in, and a fresh sowing made once in ten days. In districts with a rainfall over 40 inches, sow on raised beds from August till the rainy season is over; afterwards continue sowing till January

¹ *Lepidium*, Greek name used by Dioscorides, diminutive of *lepis*, a scale, and probably alludes to the form of the pods.

on ridges one foot apart, so that the water may run between them. It is not advisable to transplant knolkohl, because the check the plant receives increases the woody fibre.

HONESTY—*Lunaria biennis*.¹—An herb with purple or white fragrant flowers, and a large transparent dissepiment in the seed pods. It thrives if sown in autumn at 5,000 feet altitude.

MALCOLMIA MARITIMA²—*Virginian Stock*. A very pretty annual suitable for small beds or for edgings. It thrives in stations of Northern India if sown in October.

MATHIOLA ANNUA³—*Ten-week Stock*.—If sown at the beginning of the cold season may be had in flower by February. It is advisable to sow in good-sized pots, or in beds of deep friable soil, and not to transplant. Altitude 2,000 feet upward suits it.

MUSTARD—*Mohria*, *Rai*, *Sinapis nigra*⁴ when grown for salad, should be treated exactly as detailed for cress. The sort generally used for salad in Europe has pale yellow seed, but the dark seed, which is very cheap in the bazaar, makes as good salad as the other, if grown as detailed for cress.

RADISH—*Moola*, *Raphanus sativus*.⁵—To obtain this valuable esculent in good condition, a well-manured soil is necessary. In the dry districts the seed should be sown once weekly from the beginning of the rainy

¹ *Lunaria*, pertaining to the moon, from the septum of the seed pod; *biennis*, two years.

² *Malcolmia*, after William Malcolm, a London nurseryman, who published a catalogue of greenhouse plants.

³ *Mathiola*, after Peter Andrew Mathiol, an Italian physician and celebrated botanist, 1500-1577; *annua*, annual.

⁴ *Sinapis*, the old Greek *sinapi*, used by Theophrastus for mustard; *nigra*, black.

⁵ *Raphanus*, the old Greek name used by Theophrastus, *sativus*, that which is sown or planted.

season till the end of December. Where the rainfall is heavy, sowing should be begun when the rainy season is three parts over. The roots are good to eat only when they have been grown rapidly. In favourable circumstances, the small sorts come to perfection in this country in three weeks, and the large white sorts, between six weeks and two months. Select a position clear, slightly shaded at midday, and keep it moist by using liquid manure often.

MOUGRI—*Raphanus sativus caudatus*.—The Java, or **RAT-TAIL-RADISH**, in which the edible part is a prolongation of the fruit which sometimes attains two feet in length, is widely cultivated by sowing at intervals from the middle of the rainy season till December. The seed being planted in lines—usually with other dwarf crops—where it may complete growth without transplanting, or sown in lines and transplanted carefully when the lower leaves have attained full size.

ROCKET - *Hesperis matronalis*.—Thrives in Himalayan gardens from 4,000 feet altitude upward.

SAVOYS are varieties of cabbage with leaves which rise between the principal veins, giving the plant a puckered appearance. They are cultivated at 4,000 feet altitude upward.

TURNIP - *Sagalum*, *Shulgam*, *Brassica campestris rapa*.—Let the soil be well worked a foot deep at least, and manured. Sow in lines one foot apart—in the dry districts from the beginning of August fortnightly, in the districts with heavy rainfall from the end of September—and water sufficiently to keep the soil moist. Transplanting is not desirable. During the young stage this plant has a host of enemies, but in hot countries *aphis* is the chief one, and it may be combated by dusting with wood-ashes and the use of the rose watering-pot sufficiently to let the plant attain strength. If the garden is an old one, with numerous weeds in the neighbourhood, the system of preventing

insects by covering the ground with rubbish and burning it before sowing, noted on page 156, will be found suitable for this crop.

Turnips were found to thrive specially with nitrogen, 3·30 per cent.; potassium, 11·50 per cent.; and phosphoric acid, 14·10 per cent.; 3½ ounce per square yard.

WATER CRESS—*Nasturtium officinale*.¹—Where a gently running stream of water is to be found, water cress may be cultivated without any trouble. Since the irrigation canals were opened near Poona, the beds of several of the streams that flow through the city have become filled with this valuable esculent, but it appears the people do not appreciate such food. At Manchester, this herb is sold at twice the price of bread, and, in London, the quantity sold annually costs 30 lacs of rupees. It is eaten raw with bread, and powerful digestive, diuretic, cleansing, and antiscorbutic properties are ascribed to it.

To cultivate water cress, cuttings should be planted where the water is not more than 4 inches deep, and a stone placed on the cutting to keep it in place until it takes root. Fresh plantations need to be made annually. Rich friable soil is necessary.

Nasturtium, the plant which bears this name in gardens, will be found under TROPAEOLUM.

CAPPARIDACEÆ,² the Caper Bush Family,

Is a group of plants closely allied to the *Cruciferae*, but distinguished by the stamens being usually numerous and the ovary raised on the stalk. *Capparidaceae* are herbaceous or shrubby, and are easily propagated by seed. In Southern Europe, the flower-buds of *Capparis spinosa* are pickled in vinegar, forming the favourite condiment, capers.

¹ *Nasturtium*, an old Latin name used by Pliny, derived from *nasus*, the nose, *tortus*, twisted. *Officinale*, sold in shops.

² *Capparidaceae*, from the genus *capparis*, old Greek name used by Dioscorides for the Persian capers.

CAPPARIS MOONII.¹—A shrub with large white or rosy flowers, resembling a tassel, from the very abundant long rose-coloured stamens; is plentiful on the ghauts, and should find a place in the garden. It may be raised from seed sown in a deep friable soil, watered freely during the rainy, and kept dry during the dry season.

CAPPARIS SPINOSA²—*Vern. Kalvari.*—The flowers of this straggling, thorny shrub are very showy, and are produced freely during the cold season. In districts where the rainfall is between 40 and 50 inches and the soil not retentive of water, it may be used to form a fence perfectly impenetrable to cattle, ornamental, if the flowers are permitted to open, or useful, if the flower-buds are gathered and pickled. In the islands of the Mediterranean, the flower-buds of the caper are gathered just before they begin to expand, and are thrown into a cask with as much salt and vinegar as is just sufficient to cover them, and more vinegar is added as the buds are collected. This is a daily occupation during six months, and when the caper season is over, the barrels are emptied and the capers sorted and placed in small casks, with fresh vinegar, for commerce.

CAPPARIS HEYNEANA, a subscentent shrub of the Western Ghats, with alternate elliptical leaves, and white or pale-blue flowers, 4 inches in width; the two lower petals have a yellow spot at the place they touch, and the stamens are very numerous and long. The flowers are produced during April May in great profusion, and are succeeded by a globular, woody, beaked fruit, 2½ inches in diameter.

GYNANDROPSIS SPECIOSA.³—An elegant annual, 3 feet in height, with rosy flowers in terminal racemes, and digitate leaves with 7 leaflets. It thrives with heavy

¹ *Moonii*, after Moon, a plant collector.

² *Spinosa*, thorny.

³ *Gynandropsis*, allusion to the union of the stamens and the pistil.

rainfall, and should be sown during the rainy season in small patches, 3-6 feet apart, where required to blossom, and only one plant left to develop.

RESEDACEÆ, *Mignonette Family.*

This small family has a solitary member in our gardens, the well-known MIGNONETTE—*Reseda*¹ *odorata*. This sweet-smelling herb thrives if sown during August–November in a deep, friable soil containing *abundant old mortar or limestone*. The seed should be sown where the plant is wanted to bloom, and its effect is good and success more easily attained when a mass is grown. Slight shade during the hot part of the day is desirable when the plants are young, and water should be given daily at that time; but, as the roots get downwards, water should be given in larger quantities at intervals of three or four days. Occasional watering with clear liquid manure is desirable, and frequent stirring of the surface is necessary wherever liquid manure is used. Save seed by spreading a sheet under the plant and shaking it. If seed is collected in this way, it will be found more reliable than imported seed.

VIOLACEÆ, *The Violet Family.*

As represented in our gardens, this is a very small group of herbaceous plants, including the violet and heart's-ease.

A remarkable habit in fertilization occurs in this family. The showy flowers which some of the species send up well above the foliage produce very little seed, and abundant seed is produced by small flowers, on short stalks, near the root. These flowers are fertilized by their own pollen without opening fully (*cleistogamic*). This is evidently one of the very numerous arrangements for self-preservation employed by plants, and is to

¹ *Reseda*, the old Latin name used by Pliny, from *resedo*, to calm or please.

be seen in a striking degree in *Commelina communis* (Marathi *kanna*), which produces seed on *underground flowers only*.

VIOLA TRICOLOR¹—*the Pansy or Heart's-ease, Kheroo*—may be sown during September–November, and the seedlings transplanted to a bed of fine, friable soil, kept open by numerous pieces of limestone or old mortar, in a situation protected from the midday sun, where they will thrive during January–March; but generally give way in the hot and rainy season.

VIOLA ODORATA²—*the Sweet Violet, Bunufsh'eh*—grows as a perennial in gardens in the dry parts of India, if protected from bright sunshine and watered regularly. The most satisfactory results are attained by arranging a bank sloping northwards, on the shady side of a tree, and giving fresh soil, with abundant limestone in it, about once in six months. The flowers appear at various times, but are most abundant at the end of the rainy season.

Viola bedding varieties, or tufted pansies, are very satisfactory if sown in August–October, with a rainguard, and planted in a bed of rich, well-tilled soil, shaded from high sun, and kept moist.

BIXACEÆ, *The Arnatto Family.*

This small group has two representatives in our gardens well worthy of their place, and giving very little trouble to cultivate.

BIXA³ ORELLANA—*the Arnatto tree, Latkan, Kesher-ke-jhar, Kuppa-Manhalla*.—This small tree must not be confounded with the source of true *Kesher*, saffron, which is the dried stigmas of a lily, *Crocus sativus*, cultivated in Europe and Kashmir. This is a small

¹ *Viola*, a violet; *tricolor*, three-coloured.

² *Odorata*, sweet-scented.

³ *Bixa*, its South American name.

tree, having broadly heart-shaped, pointed leaves, and numerous white or rosy flowers with numerous stamens, succeeded by green or red capsules, with many soft spines, enclosing seeds having a covering of a deep-orange colouring matter, useful in dyeing silk and in tinting butter or cheese. The plant looks well in the shrubbery, at some distance from the path. It grows in any fair garden-soil, and is propagated from seeds.

COCHLOSPERMUM¹ GOSSIPIMUM—*Kumbi, Gameri, Konda-gogu, Pila-kapas, Gunlay*.—A small deciduous tree, with three- to five-lobed leaves, which become yellow and withered soon after the rainy season, falling towards the end of the year, and, during the hot season, has bright yellow flowers, 4 to 5 inches in diameter, succeeded by a five-lobed capsular fruit, as large as a goose egg, which separates into two layers, showing a whitish, membranous endocarp and numerous seeds, the size of a small pea, enclosed in long cottony fibre. This tree thrives in the Botanical Garden at Calcutta, where the soil is deep alluvium, and near some of the hill-temples on the Western Ghats, where the rainfall is heavy.

ABERIA GARDNERII—*Ket-embilla* of Ceylon.—A small tree of Ceylon, thriving in loamy soil at medium altitudes; yields a fruit resembling the gooseberry, which is excellent in tarts and jam. It is propagated from seed, and plants are procurable at Paradeniya Botanical Garden.

FLACOURTIA INERMIS—*Lovi-lovi* in Ceylon.—A handsome tree adapted for a moist climate, and bearing an acid, red, cherry-like fruit, good in tarts. It requires a deep, rich soil, and is easily raised from seed.

PITTOSPORACEÆ, *The Pitch-Seed Family.*

A group of small trees or shrubs with alternate, entire, very rarely toothed, exstipulate leaves, often arranged in whorls towards the ends of the branches. The garden

¹ *Cochlospermum*, shell-seed.

species of *Pittosporum*¹ have greenish-white, or yellow, sweet-smelling flowers, succeeded by a capsular fruit, which splits open and displays the black, pitch-like seeds contrasted with the bright red of the inside of the capsule.

P. FLORIBUNDUM—*Yekadi, Vehyenti*—and P. DASYCAULON—*Gapsundi*—are small trees or shrubs of the Western Ghats, and useful shrubbery or hedge plants under a heavy rainfall.

CARYOPHYLLÆ,² *The Pink and Carnation Family,*

Are herbs with stems swollen at the nodes, and sessile, linear leaves, chiefly occurring in temperate climates.

AGROSTEMMA CORONARIA.³—An herb having abundant crimson or white flowers; thrives at 3,000-7,000 feet altitude, if sown when the rainy season is over, and protected from high sun and drought.

The CARNATION and PICOTEE—*Dianthus caryophyllus, Gul-Karanphul*—thrives especially at hill-stations with 3,000-5,000 feet altitude, and rainfall about 50 inches. From such altitudes plants may be brought lower than 2,000 feet, and placed on the north side of a house, where they will bloom until exhausted. At the higher altitude, plants may be raised from seed, and the best sorts increased by layering during the autumn months. Turfy loam, enriched with leaf-mould and kept open by shell-sand and crushed charcoal, is the soil desirable.

DIANTHUS CHINENSIS⁴—*China Pink, Kuranphul*.—Seed of this beautiful herb may be sown any time during May–November in the dry parts of the country, but,

¹ *Pittosporum*, pitch-seeds, from their pitch-like appearance.

² *Caryophyllæa*, from the perfume resembling cloves, from *karnon*, a nut, and *phyllon*, a leaf.

³ *Agrostemma*, two Greek words signifying a field and a wreath. *Coronaria*, pertaining to a crown.

⁴ *Dianthus*, *dios*, divine; *anthos*, flower, *Chinensis*, of China.

where the rainfall is heavy, sowing should be deferred till September; a deep, sandy, well-manured, and drained soil is necessary. The seed may be sown on a bed of carefully-tilled soil, and the seedlings planted out six inches apart.

GYPSOPHILA ELEGANS and **SAPONARIA CALABRICA**.—Annuals with abundant tiny pink or white flowers; may be sown during autumn at 5,000 feet altitude, with northern exposure.



DOUBLE PINKS

SWEET WILLIAM—*Dianthus barbatus*.¹—From 2,000 feet altitude upwards, with light rainfall; seed may be sown during July October, and the young plants separated as they increase in size. Some fine blossom may be obtained during spring if the plants be shaded slightly and kept moist as the season advances.

LYCHNIS FLOSCUCULI²—*Ragged Robin*.—An herb with opposite sessile leaves, $2\frac{1}{2}$ by 1 inch, and heads of pale pink flowers of a ragged appearance. The treatment is the same as the Carnation.

¹ *Barbatus*, bearded

² *Lychnis*, from *lychnos*, a lamp. *Floscuculi*, the cuckoo-flower.

POLYCARPÆA CORYMBOSA ¹—*Vilaisedachi*.—An erect annual, 9 inches in height, with small, narrow leaves and minute, bright silvery terminal flowers, which retain their beauty when dry. It is abundant in dry pastures in the Deccan during the rainy season, and is worth attention for use in bouquets, table decoration, and wreaths. It should be sown in sandy soil where it is intended to finish growth, the plants thinned and watered occasionally during dry weather.

VISCARIA OCULATA thrives at 4,000 feet altitude upward, if sown during August–October, on a bed of well-tilled soil on the northern side of a house, and thinned as growth progresses.

SILENE PENDULA ²—*Catchfly*. If sown in October, on good soil, and regularly watered, this annual is showy by January with numerous pinkish flowers.

PORTULACÆÆ, *The Purslane Family.*

A group of herbs or shrubby plants, with succulent leaves, valued as pot herbs and ornamental plants.

PURSLANE—*Ghol*, *Loonya* or *Noonya Shak*, *Passelie-Keerey*, *Portulaca oleracea*.³—An annual succulent herb, often appearing as a weed in gardens. Prepare a bed of friable, rich soil, water thoroughly, sow the very fine seed thinly, and sprinkle a little dry soil over it. Shade slightly to prevent rapid drying until the seed has germinated. Any time between June and March is suitable. During the rainy season the bed should be raised to allow perfect drainage, and fresh sowings should be made fortnightly to keep it in good condition. The indigenous

¹ *Polycarpæa*, many-fruited. *Corymbosa*, having flowers in corymbs.

² *Silene*, said to be derived from *sialon*, saliva. *Pendula*, hanging.

³ *Portulaca*, the old Latin name used by Pliny, but by him spelt *Porcilaca*. *Oleracea*, culinary.

variety spreads on the surface and is difficult to keep clean: the varieties cultivated stand upright and produce larger leaves than the wild sort. Green and golden varieties are in cultivation.

PORTULACA GRANDIFLORA is a very low-growing herb. Sow where it is wanted to grow, between September and November, having the soil thoroughly manured, drained, and watered, previously, as the seed is very minute. *Portulaca* may also be propagated by sprinkling fine soil among the side branches and removing such as have rooted. As an overhanging edging for plant-tubs, nothing is more beautiful.

CALANDRINIA GRANDIFLORA.¹—A Chilean herb, with fleshy leaves and showy flowers, resembling *Portulaca*. It grows nicely from 2,000–7,000 feet altitude, if sown during August–October.

TALINUM CUNEFOLIUM.²—A pretty herb, with an upright stem bearing alternate, succulent, wedge-shaped leaves, and terminated by a graceful panicle of small, rose-coloured flowers during September–December, succeeded by a small globular, three-valved capsule containing several seeds. It thrives at hill-stations, and may be propagated by seeds or cuttings.

PORTULACARIA AFRA³—*the Spekboom* or *Purslane tree*.—A miniature tree with a thick stem and drooping branches, bearing small wedge-shaped, or circular, succulent, opposite leaves. The flowers are pink, but are rarely seen in hot climates. It is a native of South Africa, and is used as a pot herb. When planted in an ornate tub, with rich, stony, soil, it is very ornamental.

¹ *Calandrinia*, after M. Calandrini, an Italian botanist. *Grandiflora*, large-flowered.

² *Talinum*, said to be the name given by the negroes of Senegal, by whom it is eaten as a salad. *Cuneifolium*, having wedge-shaped leaves.

³ *Portulacaria*, from its resemblance to *Portulaca*. *Afra*, African.

TAMARISCINÆ,¹ *The Tamarix Family.*

The cultivated members of this small family are graceful shrubs or trees with slender branches, minute leaves, and abundant small white or rosy flowers. Their natural habitat is sandbanks in rivers, but they thrive in ordinary sandy soil, freely watered during the rainy season, and are very ornamental. The branches and galls produced on them, called *maij* or *burri maij*, are valued as a mordant by tanners and dyers. Among the species worthy of cultivation are TAMARIX GALLICA,² *Jhavuka*, *Jhou*, *Jhouca*, *Jhaoo Lai*, *Casurnee*; TAMARIX DIOICA,³ *Lai jhou*, *Pichulu sarru*; TAMARIX ARTICULATA,⁴ a useful roadside tree, much planted at Lahore, suitable for a climate with extremes of temperature, and propagated by seed and cuttings; and TAMARIX PALASII of Eastern Europe and Afghanistan, with abundant bright rosy flowers in terminal panicles.

HYPERICINÆ,⁵ *St. John's Wort Family,*

Are herbs or shrubs with opposite leaves, often with pellucid glands, or dark glandular dots, and showy flowers; temperate climate plants, occurring in Himalaya and mountains of warm regions.

HYPERICUM MYSORENSE.⁶—A shrub with four-angled branches and opposite leaves, 1 to 2 inches in length, tapering to an amplexicaule base, with slender ascending veins, pellucid striæ, and bright-yellow flowers, 2 to 2½ inches in diameter.

¹ *Tamariscinea*, from *tamarix*, the old Latin name used by Pliny.

² *Gallica*, French.

³ *Dioica*, having male and female flowers on separate plants.

⁴ *Articulata*, jointed.

⁵ *Hypericinea*, from the genus *hypericum*, an old Greek name used by Dioscorides.

⁶ *Mysorensæ*, from Mysore.

H. PERFORATUM.¹—A perennial herb attaining 18 inches and having $\frac{3}{4}$ -inch obtuse leaves, with black dots on the pale undersurface. The flowers are 1 inch in diameter and bright yellow, in a terminal corymb, and the petals have dark spots near the margin. This shrub should be more common in hill-gardens. Propagated by division and seeds.

GUTTIFERÆ,² *The Mangosteen and Camboge Family.*

A group of trees or shrubs abounding in yellow or greenish juice, and including trees valued for delicious fruit (Mangosteen), sweet flowers (*woondee*), and fine timber (Poon spars).

GARCINIA MANGOSTANA—*Mangosteen*.—A small, conical tree, 20 to 30 feet, with entire, leathery leaves, 6 to 10 by $2\frac{1}{2}$ to $4\frac{1}{4}$ inches, having regular, close nerves. The flowers are male in terminal fascicles, and bisexual solitary, or in pairs, succeeded by smooth, dark-purple, oblate-globular fruit as large as a small orange. The covering of the fruit is firm, with a spongy, internal layer, and contains large flattened seeds, having a white fleshy growth from the seed-stalk (*tigellus*), which is the part eaten.

This fruit tree is a native of, and cultivated in, Malaya and Southern Tenasserim, and is also cultivated in the hottest and most equable moist districts of Southern India and Ceylon. It is easy to obtain seedling plants from its native habitat, and many attempts to cultivate it throughout India have been made, so far without success. It proves of very slow growth, and it is questionable whether, if those seedling plants gave fruit, the produce would be equal to that which has given this plant its reputation of bearing the most delicious fruit known—it has been compared to “perfumed snow.” The

¹ *Perforatum*, perforated.

² *Guttiferae*, from the genus *guttifera*, from *gutta*, caoutchouc, and *fera*, bearing.

fruit borne by seedling fruit trees is variable, and the finer varieties, which are propagated by layering and grafting, repay the cost of cultivation better than seedlings. The cultivation of the Mangosteen in Deccan, Central India, and Bengal, would present much less difficulty than the cultivation of grapes and pineapples in England, and, surely, some of the Indian noblemen will take up its cultivation. It would be necessary to provide a

MANGOSTEEN HOUSE.

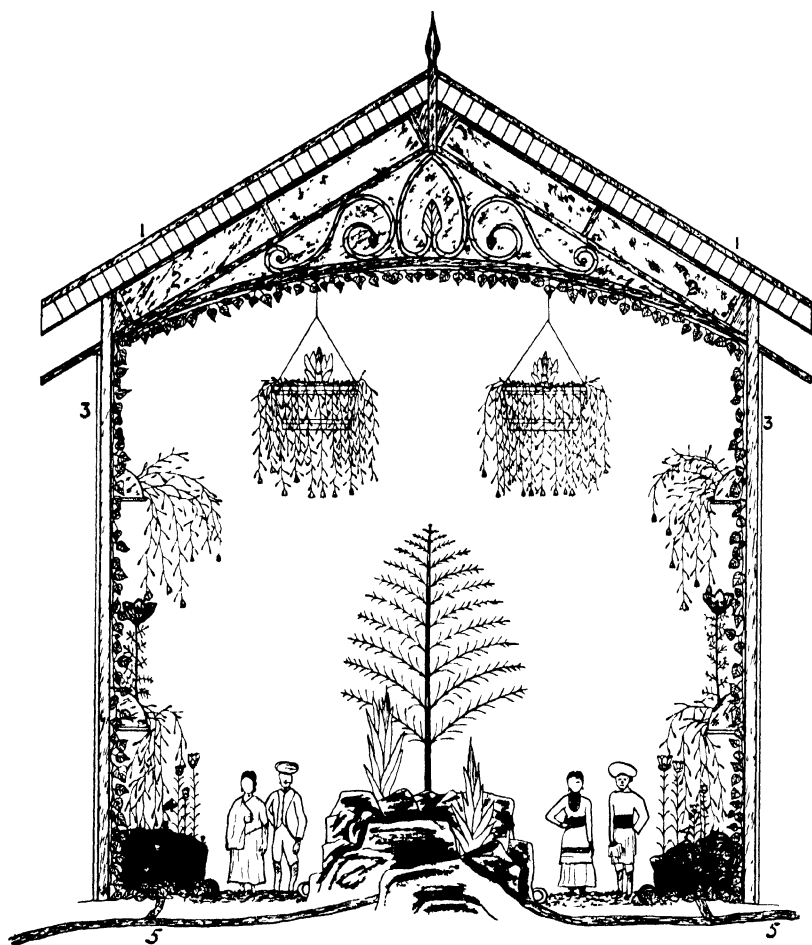
The object of this design is to produce a moist atmosphere without open water, in which mosquitos may breed. The windows are of glass, arranged to move on small wheels, so that they may be moved up or down easily yet not be carried off by storms. The louver boards are furnished with hinges, and may be set at any angle. The most usual will be to admit direct sunlight up to nine o'clock in the morning and after four in the evening. Between these hours the sunlight in the house is nearly full, but it is indirect, and frequent attention is unnecessary. The glass enables heavy rain to be kept out, and the louver boards prevent damage from hailstorms.

It is important to remember that a large house retains an equable temperature better than a small house, and 100 feet by 35 feet, and 20 feet high in the centre, is desirable. The drainage should be arranged carefully, and the water supplied by pipes led into a tank which can be covered so as to exclude mosquitos, which would lay their eggs on the water.

The mangosteen, the pineapple, the finest sort of banana, and moisture-loving orchids may be grown there, and when in bloom removed to the dwelling-house; and the pitcher plant will also be at home in it.

MESUA FERREA¹—*Nag champā*, *Thorla champā*, *Nag kesura*, *Nagsara*.—A striking small tree, having a

¹ *Mesua*, after *Mesue*, Arabian botanists of the eighth and ninth centuries. *Ferra*, iron-wooded.



MANGOSTEEN HOUSE.

1. Louvre boards hinged to bars at both sides, so that they may move together as required to give shade from direct sunshine but nearly full light.
2. Space between the louvre boards and the glass, about 1 foot in depth.
3. Movable side shutters to slide on runners, and to open half of the side area.
4. Rocky bank of rich soil.
5. Drainage pipes, desirable every ten feet.

With open sides and less moisture, this design is fit for the fine varieties of Grapes which will not thrive under full sunshine.

straight stem; opposite, leathery, lance-shaped, drooping leaves; and large pure white flowers. A deep, stony soil, with thorough drainage and abundant water during the monsoon, is suitable. Propagate by seeds, which must be fresh when sown.

GARCINIA INDICA—*Kokum, Ratamba, Birand, Brindoa*.—A small tree of upright, conical habit; the branches ultimately drooping and bearing opposite, obovate, entire leaves 3 by $1\frac{1}{2}$ inches, of a bright coppery colour while young, and dark green, smooth, and leathery when mature. The flowers are small, and are succeeded by globular purple fruit the size of a small orange, containing several large seeds, from which a concrete oil is obtained by crushing and boiling the seed in water. The tree thrives in districts within the influence of the sea breeze, but rarely bears fruit inland. Propagate by seed.

*CALOPHYLLUM INOPHYLLUM*¹—*Woondee, Sultana champ*.—A tree of crooked growth, to be found on the Malabar coast. It has opposite, oval, entire, bright shining leaves, 4 to 8 by 3 to 4 inches, on stalks $\frac{1}{2}$ to $1\frac{1}{2}$ inches, and pure white fragrant flowers $\frac{3}{4}$ inch in diameter, produced abundantly nearly throughout the year, and succeeded by globular, smooth, yellow, one-seeded fruit 1 inch in diameter. This tree thrives well in moist districts, and in the public gardens at Bombay and Calcutta fine specimens may be seen; and in positions sheltered from hot winds and freely watered it also grows inland. In dry districts it needs a deep, stony soil, with slight shade and regular watering while young.

MAMMEA AMERICANA.²—A tree of Central America, resembling the *wundi*, and thriving in the same moist climate. It has fragrant white flowers, which yield *Eau de Creol* by distillation, and a fruit which is much valued. Raised by seed.

¹ *Calophyllum*, beautiful leaf. *Inophyllum*, fibrous leaf.

² *Mammea*, from the Haytean name Maney.

OCHROCARPUS LONGIFOLIUS¹—*Suringee, Punaga*.—A remarkable small tree, a native of Kanara and other moist districts. It has a straight stem with opposite branches disposed at nearly right angles, and bearing opposite, entire leaves 8 to 10 inches in length by 2 to 2½ inches in breadth; bright copper-coloured while young, and when mature dark green, leathery, and pendulous. The flowers are white, have four petals, and produce obliquely ovoid fruit tipped by the hard-pointed style. It is propagated by seed, and needs shelter from hot winds.

PENTADESMA BUTYRACEA²—the tallow tree of Tropical Africa—is a tall tree with yellow juice and opposite leaves which grows in moist districts. Propagated from fresh seed.

TERNSTRÆMIACEÆ,³ *The Tea Tree Family*,

Consists of shrubs and trees with alternate leaves and handsome flowers, rarely small. The tea tree and the camellia flower of temperate climate gardens are sufficient examples.

The **TEA TREE**—*Camellia thea*,⁴ *T'cha* is a shrub with alternate very short-stalked, elliptical-oblong, serrate, dark-green leaves and white flowers about 1 inch in diameter, produced in abundance if the young leaves are not gathered for tea. It is worthy of cultivation as a conservatory plant, and should be prominent in every educational garden. Any rich loamy soil is suitable, and it is easily raised from *fresh* seeds.

¹ *Ochrocarpus*, yellow fruit. *Longifolius*, long-leaved.

² *Pentadesma*, referring to the stamens being united at the base into five short columns. *Butyracea*, buttery.

³ *Ternstræmiacea*, after Christopher Termstrøm, a Swedish naturalist.

⁴ *Camellia*, after George Joseph Camellus, a Moravian Jesuit.

The following is a more complete account of the

CULTIVATION OF TEA (*TEA*).

The profitable cultivation of tea needs a climate with a mean annual temperature of 65 to 75 degrees Far., the highest quality being produced at the lower and the greatest yield at the higher temperature. The minimum, shown by a thermometer on the ground, should not go below 40 degrees Far. A rainfall of 100 inches yearly, well distributed throughout the year, and the frequent passage of low clouds which bathe every leaf in dew, are desirable. A suitable soil is deep yellow sandy loam which has produced heavy forest or rich growth of grass, and *jeels* or shallow marshes, after being drained thoroughly, yield extra rich crops of tea. Carbonate of calcium may be wanting in tea soil if 7 per cent. of carbonate of iron be present. Of phosphates and sulphates of calcium a trace is sufficient for tea.

The tea plant is raised from seed which has been gathered ripe in September, and must be planted as early as possible after gathering, because the power of germinating remains only a few weeks. If transport be necessary, it may be packed in a box in single layers, each with a coating of charcoal dust and stout paper between the layers. Good seed is $\frac{1}{4}$ -inch in diameter and sinks in water, and immediately on receipt should be spread out on moist sand and shaded until it sprouts. Usually each seed is planted separately, a board with holes six inches apart and a peg fitting the holes and going deep enough to let the seed be one inch beneath the surface, being used to regulate planting by unskilled hands. The nursery should have a very thoroughly tilled soil, arranged in beds with raised paths between sufficiently high to bear transverse rods on which nets may be spread when necessary. Crickets are injurious at this stage, as they nip off the young shoots; the vermin may be caught by children, who, when suitably rewarded, learn to poke a straw into the cricket's hole and catch the insect as it comes out. Some planters put

the seed down "at stake"—that is, at places marked by stakes at regular distances apart in the prepared field. This saves transplanting but requires much seed, as several are planted at each stake. When the nursery plants have the latest growth firm and the weather is moist, the plants are taken up, each with a "ball" of earth on its root and its tap root carefully preserved, or, if broken, cut cleanly with a sharp knife. The field planting is usually 4 feet apart.

Plucking begins with "tips"—unopened leaf buds—and at three to four years old becomes general; two leaves and a bud is the general rule. More leaves give a coarse tea, fewer an expensive sort. Hoeing the ground once a month, each man doing 500 square yards as a daily task, is usual. All weeds and prunings are buried on the spot.

Pruning.—Constant plucking induces knotty branches which interfere with free circulation of the sap, and a yearly pruning is directed to the removal of knotty, dead, or crowded branches, keeping the bush with a level head within easy reach of the hand, the branches radiating from the centre and of equal growth, so that the "flush" or young growth may be equal throughout. When, after five or six years' plucking, the branches have become very knotty, they are cut back to six inches from the ground, and manure dug in at the roots. As the composition of soils is variable, a special manure for tea—or, indeed, for any crop—is not to be expected. All sorts of organic refuse from the "lines" and houses on the estate, including wood ashes from the furnaces and stable litter, piled together, thoroughly mixed, and protected from washing by heavy rain, form a very good manure, only too limited in quantity. As an extra, fish guano which has been mixed in the field with a large proportion of soil and allowed to lie a few months before application to the roots, is, when applied at the rate of 2 cwts. per acre, a safe and useful application. Deer, monkeys, hogs, and cattle have to be guarded

against with barbed wire on posts of any convenient tree which roots freely from large branches.

TEA PESTS.

Red Spider is a small reddish mite which infests the lower side of the tea-tree leaves, and forms a kind of web over its eggs, causing the leaves to curl up. Apply kerosene mixture in a strong spray through a tube arranged to throw the spray, under strong pressure, upward from the ground level. This being done when there is no "tea" on the plants is quite unobjectionable, but the alternative preparation of tomato leaves, green tobacco leaves, or agave leaves, crushed or cut into small pieces and soaked in water twelve hours, then strained through a sack and sprayed as above, has the advantage that an overdose is beneficial to the crop. The mixture, if kept a few days ferments, and alters.

Mr. Ernest Green, the well-known Ceylon entomologist, describes ten species of caterpillar that are destructive to tea, and proposes the use of arsenate of lead during the off season, so as to destroy the small broods that later multiply so greatly, or otherwise to stop plucking during ten days after spraying. By that time the tea that becomes ready will not have any of the poisonous powder on it.

Mosquito Blight (Helopeltis theivora).—Suctorial insects with active pupa; may be treated with kerosene emulsion.

The caterpillar of the moth, *Stanropus alternans*, is at times destructive in Ceylon, and the water in which crushed agave leaves have been soaked may be sprayed on the plants to render the leaves less palatable.

Coral Disease is a fungus which comes to fructification as a small coral-red formation on the leaves and stems. As the destructive work is done before the fructification appears, nothing but fire can be recommended.

Grey Blight (Pestalozzia Guepini).—A fungus spreading in irregular grey patches, studded with minute black points; and

Blister Blight (Exobasidium vexans)—at first a pinkish semi-transparent spot, ultimately depressed, forming a blister on the lower face of the leaf—are combated by spraying with Bordeaux mixture during the off season and hand-picking at other seasons.

Thread Blight of the tea plant (*Stilbum nanum*).—Whitish threads on the branches and under surface of the leaves—the spawn—which lives on dead wood in the soil and has entered by the root; and

White Root Rot (Rosellinia radiciperda).—The root becomes covered inside the bark with delicate white spawn, and the pest spreads through the soil by its spawn. Those two formidable diseases are combated by the application of quick-lime and drainage, and burning instead of burying prunings.

Red Rust of the tea plant (*Cephaleuros mycoidea*, Karst) is a lichen—a composite growth, consisting of a fungus and a red alga living together. At first reddish, “when fully developed the lichen is whitish and the fruit-bearing parts often pure white and resembling porcelain in appearance” (*Massee*). The red condition is destructive, changing the leaves to a sickly yellow. The white form produces numerous spores, which increase the pest. Maintaining the vigour of the plants by high cultivation is the only remedial measure that can be recommended.

Canker of the tea plant.—“Crackling and splitting of the bark and wood and the formation of cankered wounds having the bark and wood eaten away. On young shoots the bark is often destroyed all round” (*Massee*). Prune off and burn the affected parts, and cover the wounds with tar.

PREPARATION OF TEA.

The green leaf having been brought in and weighed, is laid in heaps and turned over a few times during 24-48 hours, dependant on the temperature of the fermenting house. During this time a slight fermentation and change in colour takes place. It is then passed through a rolling mill, and on to the drying stove, where a short exposure to 400 degrees Far. is sufficient to extract superfluous moisture. In these important operations a high degree of skill, only obtainable by experience, is necessary to produce well-finished tea. Separation into classes by a sifting machine, and maturing during four to six months in large bins, prepare the tea for package into boxes, either of wood lined with thin sheet-lead or into iron packages.

CAMELLIA JAPONICA.¹—The Camellia grows nicely at Utikamund and in Himalaya, from 4,000 to 7,000 feet altitude, if planted in a sheltered position with shade. It also thrives at Lahore, if treated with care, and protected from hot sun and wind. The most suitable soil is a mixture of *fibrous peat* (procurable above 10,000 feet altitude in the tropics, or from Europe) and loam, with sand, or crushed brick, and well-decayed manure. In planting, the soil needs to be very firmly packed among the roots, and it requires to be kept moist during the hot season, and to have effectual drainage. The fine varieties are propagated by grafting on a single-flowered form, which roots freely from cuttings.

CAMELLIA SUSANQUA, from Japan, in fine variegated forms, are fit for culture from 4,000-7,000 feet altitude. It likes to have soil about one-half peat.

¹ *Camellia*, after George Joseph Kamel, a Moravian Jesuit of the seventeenth century, by whom it was introduced. *Japonica*, of Japan.

DIPTEROCARPEÆ,¹ *The Two-winged Fruit.*

An important group of resinous trees. Seeds in this family retain germinating power a very short time—indeed, *sal* seed often germinates before it falls from the parent tree.

DIPTEROCARPUS TURBINATUS²—*the Gurjun Oil tree, Challan, Kamyin.*—A large tree of Chittagong and Kanara, with alternate simple entire leaves, 5 to 12 by 2½ to 7 inches, with 14 to 18 pairs of lateral nerves, and pinkish-white flowers, 3 inches in diameter, at the beginning of the hot season, succeeded by a nut-like fruit, with two erect wings, 5 by 1 inches. The *gurjun* oil is obtained by tapping the stem. It is difficult to get seed in germinating condition, but it might remain alive if packed in damp earth.

SHOREA ROBUSTA³—*Sal*—is an immense timber tree of the Eastern districts of Central India, which is sometimes raised in gardens for roadside planting; but it is more advantageous to dig holes where the trees are required, fill with surface-soil mixed with manure, and plant several seeds as soon as ripe. If several plants appear, the weaklier may be pulled out.

DIPTEROCARPUS ALATUS,⁴ on the bank of a tank in the Calcutta Botanic Garden, makes a fine tree, with a straight clear stem and a spreading head.

MALVACEÆ, *The Mallow or Bendi Family.*

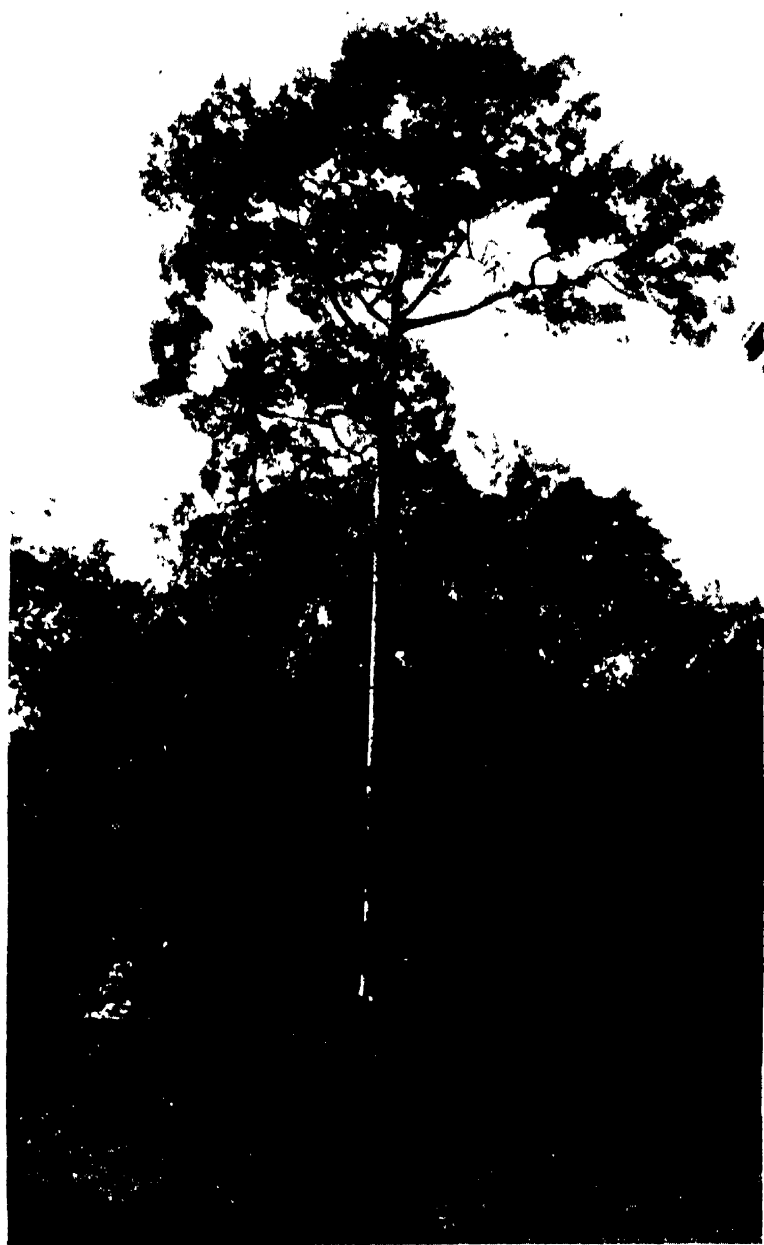
This is a large group of plants of great importance, both from an economic or an ornamental point of view. Of economic importance, it includes cotton, *ambaree*,

¹ *Dipterocarpeæ*, from the fruit having two wings.

² *Turbinatus*, like a wheel.

³ *Shorea*, after Sir John Shore, Governor-General of India, 1793–1797. *Robusta*, quick-growing.

⁴ *Alatus*, winged.



DIPTEROCARPUS ALATUS.

the *bendi*, and many other valuable plants; while as garden plants, what are more beautiful than the many varieties of *Hibiscus* (*Jasundi*)? In this family, propagation is effected chiefly by seeds, but the shrubs are generally propagated by cuttings. The annual sorts have strong tap roots, and develop grandly if sown where required to bloom, on a rich, stony soil, freely watered.

ABUTILON STRIATUM.¹—Many varieties of this shrub, with flowers of various colours, may be got from a packet of seed. It enjoys a rich loam and frequent re-potting.

ADANSONIA DIGITATA—*the Baobab, Gouruk Chintz.*—A very remarkable tree, with a trunk of great thickness in proportion to its height, mentioned in Livingstone's travels as the Baobab, and in Colonel Taylor's novel with sinister associations. One has attained a girth over 30 feet at Karanja, Bombay. It thrives without special care in a deep, strong soil, has very strong fibre in its bark, and produces a large woody fruit, used by fishermen as floats. It may be raised from seed.

BOMBAX MALABARICUM²—*Kanta-Scirie, Sulmuli, Simul Burgha, Kattu-Imbul-Cey.*—A showy tree, armed with thorns on the bark, and having leaves divided into finger-like portions rising from one point (digitate), and large red flowers appearing while the tree is without leaves in the hot season, succeeded by large pods, containing white hairs resembling cotton. A deep, stony soil, with abundant water at long intervals, is suitable. Propagation is by seed.

BOMBAX INSIGNIS,³ which occurs throughout the Konkan, differs from the above in larger pink flowers and the absence of thorns on the trunk.

¹ *Abutilon*, the Greek name for the mulberry—applied to this genus from the resemblance of the leaves. *Striatum*, striped.

² *Bombax*, one of the Greek names for cotton. *Malabaricum*, from Malabar.

³ *Insignis*, remarkable.

DECASCHISTA TRILOBATA¹ is a pretty, small shrub, having bright-coppery hairs on its three-lobed leaves, and abundant yellow flowers, 2 inches in diameter, yellow with a purple centre. It is adapted for a district with heavy rainfall, and is raised from seed without transplanting.

THE DURION—*Durio*² *zebethinus*; vern. *Durion*—is a tall tree occurring in Tenasserim and Malaya, having alternate, entire leathery leaves, 4-5 inches long, by 2-2½ inches broad (densely ferruginous-scaly beneath), with petiole of 1 inch, and bearing flowers on the larger branches, each enclosed in an involucral sac—like an extra calyx—which tears irregularly as the flower opens and the very numerous stamens develop. The ripe fruit is about 6 by 5 inches, with a hard rind covered with spines, and, when crushed by the foot, splitting into five segments and disclosing seed enveloped in abundant pulp of a civet-like odour and terebinthinate flavour, greatly valued by those who have acquired a taste for it. The fruit is in season during June-July and during December-January.

Specially endowed with protective armour of silvery, or coppery, scales, this tree seems unable to bear a climate which is dry even for a part of the year. 17° N. and 95° E. are stated by Ferrier to be the limits of its production in Burmah. It thrives in moist districts of Ceylon, and the seeds retain vegetative power only a few days; but plants are procurable at Paradeniya Botanical Garden very cheaply. Commonly raised from seed, which must be quite fresh. Superior sorts may be increased by *guti* layers.

ERIODENDRON ANFRACTUOSUM³—*Shameula*, *Safed Simul*.—A large tree much resembling the above, but with white flowers and fewer prickles. Its cultivation is similar.

¹ *Trilobata*, three-lobed.

² *Durio*, from the vernacular name *Doryon*.

³ *Eriodendron*, *erio*, wool, and *dendron*, a tree. *Anfractuosum*, curled.

GOSSYPIMUM.¹—The various species of this genus, which yield the different kinds of cotton, are not much grown in gardens; but, as they are highly interesting and very beautiful plants, they are well worthy of a place. Moreover, if cultivated in gardens, these plants would be more likely to cross-breed, and some of the varieties produced would probably yield cotton of better quality than is at present obtained from the fields. In any case, the cotton tree is quite as beautiful, and a great deal more useful, than many of the plants called Crotons.

HIBISCUS² ABELMOSCHUS—*Kusturi-Bendi* (Musk Mallow).—A tall, hairy annual, bearing showy flowers 3 inches in expansion, in colour yellow with a purple centre, succeeded by flattened, hairy pods, containing compressed kidney-shaped seeds, having a musky odour when crushed.

HIBISCUS CANNABINUS—*Ambari, Mestapat, Pulu, Sujjado, Gungkura*.—A common pot-herb in its young state: for this purpose, it should be sown on a rich soil and regularly watered, so as to produce succulent growth. Fresh sowings may be made once in ten days between June and March. When grown during the rainy season as a field crop, the inner bark yields an excellent fibre for ropes.

HIBISCUS COLLINUS.—A large shrub bearing, in August, very abundant flowers, 4 inches in width, white or pale rose, with crimson centre.

HIBISCUS ELATUS³—*Cuba Bast Tree, Mahoe of the Indies*.—In a deep, loamy soil at Poona, this tree thrives and bears its large fleshy-petalled, sulphur-coloured flowers freely.

HIBISCUS ESCULENTUS⁴—*Bhendi, Okra, Ramtooray, Dharoos, Bundayka*.—The young fruit is a nutritious

¹ *Gossypium*, the Latin name used by Pliny for the cotton plant.

² *Hibiscus*, from *hibiscos*, the Greek name of the mallow.

³ *Elatus*, tall.

⁴ *Esculentus*, eatable.

vegetable of high quality which would be highly esteemed, if costly. Dwarf early varieties, without stiff hairs, are in cultivation, and may be sown in lines on very rich, highly-tilled soil fortnightly, from May till December, in dry districts, and after the heavy part of the Monsoon is over in wet districts.

In *Pharma. Ind.*, I. 212, it is quoted:—"Popp has examined the fresh capsules, and he states they abound in pectin, starch, and mucilage; when dried they afford 2-2.4% of nitrogen and an ash rich in potash, lime, and magnesia."

HIBISCUS FURCATUS.—A native of the Western Ghats, near Vingorla, is a showy plant of climbing habit, and rough all over with recurved prickles. The flowers are solitary axillary, pedunculate, 4 inches in width, of golden colour, abruptly changed in the centre to deep crimson, the stamens are dark brown, and the involucral bracts have each a leafy, horn-like appendage.

HIBISCUS LILIIFLORUS¹ resembles the common *Jasundi*, but has flowers of greater substance and leaves often entire, or much less toothed, than other varieties. Cuttings of this variety need care to root.

HIBISCUS MANIHOT.—A tall annual having alternate, deeply-divided palmate leaves attaining 12 by 12 inches, 4-5 bracts, calyx split down one side, and corolla 5 inches wide, bright yellow, with crimson centre. The pod is 2½ inches by 1 inch, rough, and many-seeded

HIBISCUS MUTABILIS²—*The Changeable Rose*.—A tall shrub of rapid growth, bearing alternate, dull-green, heart-shaped leaves, and flowers 5 inches in width, often "double," which change from white to deep crimson, and may be found of all the intermediate shades; appearing in September. The plant grows freely in a rich soil regularly watered, and should be propagated from cuttings yearly, as it remains vigorous only about three

¹ *Liliiflorus*, lily-flowered.

² *Mutabilis*, changeable.



HIBISCUS ROSA SINENSIS, WITH FRUIT

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HIBISCUS ROSA SINENSIS, WITH FRUIT

years. The natural form of this flower has 5 petals, is more ephemeral than the double form, and may be raised from seed.

*HIBISCUS PANDURÆFORMIS*¹—*Fiddle Mallow*.—One of the numerous plants called *rán bendi*; may be seen at the side of the railway between Lanowlee and Poona during the cold season. It is an erect-growing plant, attaining six feet in height, but dying down to the ground during the hot season. The flowers are golden coloured with a dark centre and fugacious, the leaves are densely clothed with soft hairs, varying from golden to dark brown in wavy shades of rich colouring. The full beauty of the leaves is disclosed by placing a few in a dinner table decoration, and even as dried herbarium specimens, they retain their beauty.

Seed sown on an ordinary garden soil in June, and watered freely during the first two months is sufficient.

*HIBISCUS ROSA SINENSIS*²—*Jasundie, Juwa*—is one of the brightest ornaments of Indian gardens, the large single-flowered forms being particularly bright. Cuttings of this plant root freely between June and December, and thrive in any fair garden soil enriched with garden sweepings. As it flowers much more freely when of some age than while young, old plants should be carefully looked after, and any dead and weakly or crowded branches removed. This *Hibiscus* is very rarely found in seed, but in December, 1879, a large number of specimens in the neighbourhood of Poona, in a great variety of situations, bore fruit, which is figured in the engraving of *Hibiscus rosa sinensis*. Typical varieties of this plant open their flowers at different times of the day, but mostly during early morning, and close again in the evening by twisting up the petals, which ultimately fall off without re-opening; double varieties remain decorative two or three days.

¹ *Panduræformis*, fiddle-shaped.

² *Rosa sinensis*, the rose of China.

The forms named *Cooperii*, with leaves variegated with many shades of rose; *Splendens*, of vigorous habit and deep crimson flowers; *Brilliantissimum*, with bright crimson flowers $5\frac{1}{2}$ inches in width; and *Gama*, with straw coloured double flowers, are specially attractive.

HIBISCUS SABDARIFFA¹—*Rozelle, Patwa, Lal-ambari*.—Should be sown in a rich seed-bed in July or August, and when six inches high, transplanted into lines two feet apart with the plants 18 inches apart in the lines. The "fruit" in this case is the calyx, which continues to enlarge after the other whorls of the flowers have fallen away; it is pleasantly acid, and makes a nice jelly.

On analysis by Dr. Lyon the calices gave per 100 parts of dry substance 27·44 of free acid, chiefly malic and tartaric. It is used as a source of acid, in the dietary of some jails, and evidently deserves more attention than has been given to it hitherto.

Dymock writes—"In bilious conditions a diet drink is made by boiling it with water and adding a little salt, pepper, assafoetida, and molasses."

HIBISCUS SCHIZOPETALUS.—A very attractive species, introduced from the hills near Mombasa about 1883. The flowers are pendulous, with recurved lacinate petals of a deep orange red and a long slender style, surrounded by the united filaments of the stamens projecting about 2 inches beyond the corolla. It is propagated by cuttings very easily. It enjoys partial shade and moisture.

HIBISCUS SYRIACUS—*The Rose of Sharon*—is an upright-growing species, having lilac flowers with a purple spot in the centre. A variety of this plant with double white flowers is a very striking plant while in bloom; it thrives in a rich alluvial soil, well drained, regularly watered. It should be transplanted occasionally and the roots trimmed, as they grow to a consider-

¹ *Sabdariffa*, uncertain, probably the vernacular name in Persian.

able length. Cuttings planted in October make good plants by the following June. There are numerous varieties of this shrub in cultivation, and it thrives in the south of England, as well as in the Deccan.

HIBISCUS TETRAPHYLLUS—*Plan-bendi*, *Jungli-bendi*.—A tall, hairy annual having 5-7-lobed leaves 1 foot in length at the base of the prickly stem, but gradually reducing upward, and flowers 5 inches in width, bright yellow with a crimson centre; it thrives with heavy rainfall, if sown on a raised bank, and is highly decorative in October.

HIBISCUS TILIACEUS¹—*Belapata*.—A small tree bearing alternate stipulate heart-shaped leaves and large sulphur-coloured flowers which appear throughout the year in gardens, but chiefly during October and November. It is indigenous in Konkan, and needs shelter when planted inland.

HOLLYHOCK—*Althaea*² *rosea*, *Gul-Khyru*—grows freely with border treatment in the Deccan; if seed be sown from August to November, the plant is in flower from December to February. A rich friable soil and abundant liquid manure are desirable for its development.

HIBISCUS VITIFOLIUS³—*Van-kapas*—is a tall, hairy herb with vine-like leaves, and flowers 3 inches in width, yellow with crimson centre.

KYDIA⁴ **CALYCINA**—*Choupultea*, *Pandiki*.—A tree from the banks of streams in Circar mountains, with straight stem and branching head, bearing heart-shaped leaves, 3-6 inches in length and width, downy while

¹ *Tiliaceus*, like the lime tree.

² *Althæa*, from the Greek name for marshmallow.

³ *Vitifolia*, vine-leaved.

⁴ *Kydia*, after Col. Robert Kyd, founder of the Botanic Garden, Calcutta; died 1794.

young, and, during the cold season, dense panicles of pure-white flowers, which yield abundant honey. It grows well at Calcutta, and is propagated by seed.

LAGUNARIA PATERSONII, a small tree ; flowers freely in northern India.

LAVATERIA ¹ TRIMESTRIS thrives at 4,000 feet altitude with the treatment given to hollyhock.

MALACHRA CAPITATA ² is useful in the garden for making a screen in places where the soil is wet, and the fibre of the bark is useful for tying purposes. It has been recommended as a field crop in the Konkan. Propagated by seeds.

MALVA VISCUS ARBOREUS ³ has small red flowers produced in great numbers. It is a suitable plant for a screen shrubbery, as it is hardy and needs little attention.

THESPESIA MACROPHYLLA ⁴—*Thespesia lampas* ⁵ of old authors; *Rán bhendi*.—A native of the Western Ghats and other hilly districts, with heavy rainfall; is one of the most beautiful of this very showy family, but seldom to be seen in gardens. The flowers are very large, of a bright pale yellow, with a crimson spot in the centre, and droop gracefully. The plant grows about 4 feet high, and should be cut down to 6 inches in February. It is propagated by seeds or cuttings. Seeds may be collected in the jungles, near Khandala, in January.

THESPESIA POPULNEA ⁶—*Bhendi Tree*, *Gangaraya*, *Huwarchi*, *Poris*, *Poresh*, *Thim-ban*—is a beautiful tree when grown from seed. The specimens commonly seen are grown from large cuttings, and have little of the tree

¹ *Lavateria*, from the two *Lavaters*, physicians and naturalists, of Zurich.

² *Malachra*, an old name used by Pliny to denote a Persian tree. *Capitata*, having flowers in heads.

³ *Malvariscus*, from *malva*, the mallow, and *viscus*, glue. *Arboreus*, tree-like.

⁴ *Thespesia*, from *thespesios*, divine.

⁵ *Lampas*, a lamp.

⁶ *Populnea*, like the poplar tree.

character. The flowers are a clear bright yellow with a maroon eye, and are succeeded by turban-shaped, black seed-pods, which hang on the tree a long time. The timber is used for the spokes of carriage wheels. In districts with a moist climate, this tree is used for roadside purposes.

STERCULIACEÆ, *The Cacao Family*,

Includes the Cacao or Chocolate tree—*Theobroma cacao*—and many other striking ornaments of the garden, generally trees with fragrant or malodorous flowers. In *Sterculia colorata* and other species, the fruit opens before it is ripe, displaying its structure in a way that is of great use to botanical students, by demonstrating the formation of the fruit from modified leaves.

CACAO¹—*Theobroma*² *cacao*—is a native of tropical America cultivated widely in hot, moist regions. In the wild state, it attains the size of a considerable tree, but, in cultivation, it is kept as a large shrub, and grown under the shade of other trees with shelter from wind. From sea-level up to 800 feet altitude suits Cacao, the principal plantations being less than 100 feet above the sea, but there are places in Colombia where it is planted as high as 1,300 feet. A rich, loamy soil is necessary, and the trees are raised from seed gathered when ripe, and *planted within ten days* of being gathered.

The seed is planted in moist, sandy soil, or cocoa-nut fibre refuse, 8 inches apart, in a sheltered place, and transplanted carefully when the first growth has become firm; or, if seed be plentiful, and the soil be specially good, it may be planted "at stake," that is, where the tree is to remain permanently. The trees are placed 10 feet apart, in lines 18 feet apart. Protection from monkeys, squirrels, and deer is necessary, and keeping down weeds

¹ *Cacao*, often spelled *cocoa* (in commerce).

² *Theobroma*, food of the gods.

and stirring the soil round the tree is the chief part of the required attention. The trees come into bearing from the third year, and produce their flowers and fruit on the stem and large branches. The fruit is gathered when ripe by cutting off carefully so as not to injure the flower-buds near the base of its stalk. The top and bottom of the fruit being cut off, the seed is extracted, with their crimson, pulpy covering, and fermented on wicker shelves in a close room, at a temperature from 116° F. rising to 140° F. during 4-7 days. During this operation, water trickles out, and when the cacao has become brown, it is spread on the "barbacue" (a cemented terrace), and by mixing with red earth, stirring and rubbing, the outer pulp is rubbed off; but machine rubbing and drying is now much adopted. When properly dried, the skin is crisp, and separates freely from the kernal—80-100 pods amounting to 4-6 cwts. of cacao "nibs" seeds per acre is a fair out-turn. There are thick-skinned and thin-skinned sorts, and both have several varieties distinguished by form and red or yellow colour.

To send cacao-seed for planting to a distance by post is almost impossible, but a fair percentage will grow if treated as follows, and sent on a voyage of not more than a week's duration. This was successful at Kew, as given in the *Kew Bulletin*:—"See that the seeds are properly ripened; wash in water carefully so as not to injure the thin seed-coat. Have soil prepared, one-half leaf mould and one-half ground charcoal. Get the soil watered so as to be moist, not wet; place half an inch of soil in the tin box; lay in the seeds; place half an inch more soil, then more seed and more soil, until the box is filled. The seeds were found to be germinated in that short time, and those that escaped fungus attack were successful. About 75 per cent. germinated."

Cacao pod disease (*Phytophthora omnivora*) occurs in damp, much-sheltered positions, and proves destructive to young pods. First it darkens the furrows near the free end, then spreads over the entire surface; later,

the pod is covered by a delicate white mould—the fruit of the fungus. Burning all diseased fruit as early as observed is recommended.

Cacao trunk disease, investigated by Mr. J. B. Caruthers, appears as a darkening of a patch of bark, which is found to be soft, full of moisture, and of a dull purple-red; minute white specks appear in cracks in the bark, which change to pink, and finally the fruit of the fungus—resting spores—appear as clusters of minute crimson balls in the crevices of the decayed bark. The disease spreads rapidly, and the most satisfactory remedy is to cut out and burn the diseased parts.

*HERITIERIA LITORALIS*¹—*The Looking-glass Tree, Sundri*.—A small tree bearing large elliptical leaves, covered beneath with minute silvery scales. Being naturally a seashore tree, it requires a moist climate, but thrives with shelter from hot wind, and irrigation. It is easily reared from fresh seed.

HERITIERIA MACROPHYLLA.²—An inland species having larger leaves than the shore sort of Looking-glass tree, but the same kind of tomentum on the lower side, on which the name is founded. It forms a large tree in moist, warm districts.

ERIOLOENA CANDOLII.³—A tree with heart-shaped leaves, 5 inches broad by 4 inches long, with 5 to 7 ribs, branching from the end of the leaf stalk, and pretty, yellow flowers, 1½ inches in diameter, appearing in January. It is indigenous in districts with heavy monsoon rains, but thrives in gardens. Propagated by seeds.

KLEINHOVIA HOSPITA.⁴—A beautiful tree which grows with fine effect in the streets and public parks of Calcutta.

¹ *Litoralis*, of the shore.

² *Heritiera*, after C. L. L'Heritiera, a French botanist of the eighteenth century. *Macrophylla*, large-leaved.

³ *Eriolæna*, *erion*, wool. *Candolii*, after Decandol.

⁴ *Kleinhovia*, after Kleinhoff, once Director of the Botanical Garden, Batavia. *Hospita*, a guest.

It has alternate, petiolate, broadly heart-shaped leaves, of very thin texture and smooth on both sides, and has large terminal panicles of rose-coloured flowers, succeeded by inflated, turbinate, membranaceous capsules. The flowers appear in August or September, and continue during the next three months. It grows rapidly in moist districts, but also thrives in gardens in the dry provinces of India.

PTEROSPERMUM ACERIFOLIUM¹—*Kurnikari, Kunuk champa*.—An elegant tree with leaves 10 to 14 inches in length by 6 to 10 inches in width, varying much in form between oblong and heart-shaped, dark green above, white beneath; thick sepals, with parallel sides, and of a golden-brown colour; the petals are pure white, 4 inches long, linear, and turned backwards; the flowers, which appear in great numbers during November–March, have a sweet perfume. This tree grows well in a loose, stony soil, manured with garden sweepings, and watered thoroughly at intervals of a month during dry weather. It is a favourite roadside tree at Bombay and Calcutta, and at Poona it thrives well in gardens. From this, the districts where it may be planted with success will be ascertained by a study of the climate tables. Propagation is by seeds and layers.

PTEROSPERMUM SUBERIFOLIUM²—*Muskunda, Muehukunda, Taddo-marum*—is a small tree with leaves 2 to 6 inches long by 1 to 2 inches broad, and has sweet-smelling white flowers. It thrives in ordinary garden soil, watered occasionally, and ripens seed abundantly, which serves for its propagation.

STERCULIA COLORATA³—*Khowsey, Bhai-koi, Bodala, Samarri, Walena*.—A tree of the Western Ghats, with alternate leaves 6 to 9 inches long by 5 to 12 inches broad, crowded at the end of the branches, where, during March,

¹ *Pterospermum*, winged-seed. *Acerifolium*, maple-leaved.

² *Suberifolium*, cork-tree-leaved.

³ *Colorata*, coloured, of a reddish brown.

it bears erect panicles of deep orange-red, malodorous flowers, wanting the corolla. Any deep rich soil is suitable. In dry districts, irrigation is necessary until the tree has sent its roots deeply into the soil. Propagation is effected by seeds.

STERCULIA MEXICANA, of South Mexico, with palmate compound leaves, thrives in shade with garden treatment in dry districts.

STERCULIA DIVERSIFOLIA,¹—*the Bottle Tree* of Australia.—Remarkable for its gouty stem; grows well in gardens in dry districts, especially at Hyderabad Sind.

*STERCULIA FÆTIDA*²—*Deodar, Kuo-mhad, Virhoi*.—A stately tree with a smooth stem rising to a considerable height without branches, which are produced in regular whorls nearly at right angles with the stem, and bear digitate leaves on long footstalks. The dull white, malodorous, evanescent flowers appear in March. Any deep rich soil is suitable. In dry district, irrigation is necessary until deeply rooted. Propagation is effected by seeds.

*STERCULIA ALATA*³ is a handsome tree of Burmah and Northern Kanara, fully described in Dr. T. Cooke's *Flora of the Presidency of Bombay*, I. 125. It is adapted for a moist climate and a deep, stony soil.

*STERCULIA GUTTATA*⁴—*Goldar, Kukar*—is worth cultivating for its remarkable fruit, resembling fine peaches in outward appearance, but hard and woody and opening before ripening.

STERCULIA VILLOSA.—A tree with palmately 5-7 lobed leaves, and long pendulous yellow flowers. Grows well in a moist climate.

¹ *Diversifolia*, various leaved.

² *Sterculia*, *Sterculius*, a Roman god, from *stercus*, dung; *fætida*, fætid.

³ *Alata*, winged.

⁴ *Gutatta*, spotted.

ZYGOPHYLLÆ, *The Bean Caper Family.*

This group is represented by—

GUAIACUM OFFICINALE.¹—The *Lignum vitæ* tree is in gardens a very beautiful shrub with jointed stems and opposite dark green leaves, each with two pairs of obovate leaflets and pale blue flowers about $\frac{1}{2}$ inch in diameter, produced very abundantly during the cold season. The extremely hard wood of this tree has valuable medicinal properties, and it thrives with ordinary garden treatment at Poona, Bombay, and Calcutta. The feathery habit of the plant is well adapted to stand singly on a lawn, and if planted among other shrubs it becomes lop-sided in seeking the light. Propagation by seeds, which may be obtained from the West Indies.

TRIBULUS CISTOIDES.²—A large variety of *Tribulus terrestris*,³ *Sarata*, is a pretty plant to grow on rock-work fully exposed to the sun in a dry climate. It has jointed procumbent branches, 1 to 2 feet long, bearing opposite, stipulate, pinnate leaves with 7 to 8 pairs of leaflets, one of which is always smaller than its yoke-fellow.

GERANIACEÆ,⁴ *The Crane's Bill Family*

is well known by the popular garden flowers noted below as a family of herbaceous plants, chiefly valued in gardens for the beauty of their flowers.

AVERRHOA CARAMBOLA—Kamaranga.—A small tree having alternate leaves with 5–11 leaflets, which contract when touched, and bearing an oblong, acutely angled

¹ *Guaiacum*, from *guaiac*, its South American name; *officinale*, kept in apothecaries' shops.

² *Tribulus*, *tries*, three; *cistoides*, resembling the flowers in the genus *Cistus*.

³ *Terrestris*, of the earth, referring to its creeping habit.

⁴ *Geraniaceæ*, from the genus *Geranium*.

yellow fruit, which is pleasantly subacid when fully ripe. It thrives especially in moist districts.

AVERRHOA BILIMBI—*Bilimbi*—has 11-35 leaflets about 2 by $\frac{3}{4}$ inches, and bears on its stem and older branches oblong obtusely lobed fruit, very acid while green and made into pickles. The Kamaranga and Bilimbi thrive with ordinary garden treatment in moist districts, and in dry climates, with occasional watering after fruit has set.

BIOPHYTUM SENSITIVUM¹—*Lalchana*.—It is a delicate little plant four inches high, with leaves composed of numerous small oblong leaflets arranged in pairs on a central stalk, and are highly sensitive. The flowers are yellow or purple, $\frac{1}{4}$ inch diameter, with the relative length of the stamens and styles variable. The plant likes a dry bank with a poor soil, and no more water than nature provides in the Deccan.

GERANIUMS—*Pelargonium inquinans*.²—Many varieties of *Pelargonium* thrive well throughout the dry districts; but success is not generally met with in parts of the country where the rainfall is heavy, because heavy rain during hot weather causes rapid decay. The plants referred to in this chapter are what are known as scarlet geraniums, although the flowers vary from white to intense scarlet. The leaves are nearly circular, soft, velvety, and having large blunt teeth on the margin. To grow *Pelargoniums*, the soil must be thoroughly well worked, turned over frequently, and enriched with manure free from dung beetle grubs, but a limited quantity of soil is desirable to induce free flowering; a deep rich soil will induce rapid growth and few flowers, shallow pots or a hard bottom to the flower bed causes abundant flowering. Cuttings should be struck during the cold season in pots, and at the beginning of

¹ *Biophytum*, *bios*, life; *phuton*, a plant—from the movement of the plant when touched. *Sensitivum*, sensitive.

² *Inquinans*, stained, probably referring to the marks on the leaf.

the rains planted out where they are to bloom. A few cuttings only should be put into each pot, as, if the roots get broken, the plants do not take freely to their fresh quarters. Some of the kinds that grow lanky and straggling should be pruned freely during the cold season, and afterwards kept dry for a few weeks until they have thrown out fresh shoots. When they have made a second growth, cuttings may be removed and the stump thrown away. Good varieties may be obtained from seed, which may be sown at any time during the rainy season. In districts where the rainfall with heat is sufficient to kill, the plants may be prepared by obtaining cuttings from Poona or Bangalore in October, which may be at once planted where they are required to bloom in soil that has been enriched with manure, a little fine sand being run in as the cutting is put in its place, and a few green branches inserted to give shade for some days.

MONSONIA¹ SENEGALENSIS is a very pretty little geranium-like plant found about 2,000 feet altitude on hills near Poona. It is propagated by seed, and may be the basis of a future race of hybrids.

PELARGONIUM² ZONALE.—*Zonal, or Horse-shoe and Tricolour Pelargoniums* are easily distinguished by the horse-shoe-like marking on the leaf, which may be dark-brown or golden, or brown and golden; are of more delicate habit of growth and adapted for altitudes over 3,000 feet with protection from heavy rainfall. In South Africa it is said that snakes avoid Geraniums.

PELARGONIUM GRANDIFLORUM.—Varieties known distinctly in gardens as Pelargoniums grow freely throughout the dry districts, but flower only at a considerable altitude, such as that of Utakamund; protection from excessive rain is provided by planting on the lee of steep banks.

¹ Lady Ann Monson, a correspondent of Linnæus.

² *Pelargonium*, from *Pelargos*, a stork, referring to the length of the fruit.

IVY-LEAVED PELARGONIUMS.—If grown in pots and the pot inserted in a hollow stump of timber, the effect of their trailing stems and bright, glossy, ivy-like leaves is very fine. A rich friable soil thoroughly drained, slight shade, protection from hot winds, and frequent watering are the conditions they thrive under.

SWEET-SCENTED PELARGONIUMS—*Pelargonium radula*¹—has leaves on rather long petioles, *palmati partite*; roughly hisped above and softly pubescent beneath; lobes narrow, linear *pinnatifid* with revolute margins. This fine plant thrives with ordinary garden treatment in the dry parts of India, and, like the other sorts, is propagated by cuttings; the flowers are rarely seen.

PELARGONIUM QUERCIFOLIUM²—*Oak-leaved Pelargonium*.—With strongly-scented leaves, shortly petiolate, cordate at base, *sinuato-pinnatifid*, hairy, with lobes rounded, and margins wavy and crenated. This plant is very satisfactory if grown where it may be protected from full sunshine, on a bank of earth having abundant lime rubbish in it, and regularly watered. A handsome white variegated form is in cultivation.

Cross-bred varieties of *Pelargonium* are extremely numerous and evanescent. Lists may be found in nurserymen's catalogues.

HYDROCERA TRIFLORA—*Neer ganaroo*.—A beautiful annual found in marshy places and the margins of ponds in Bengal. The leaves are linear, lanceolate, and serrate, and the peduncles three-flowered; the flowers are one inch in diameter and variegated with white, red, and yellow. It is propagated by seed and cuttings.

IMPATIENS BALSAMINA—*Terda, Dupati, Gulmindi*.—An annual with showy flowers of many shades from pure white to crimson.

¹ *Radula*, a scraper, from the form of the leaf.

² *Quercifolium*, oak-leaved.

Double-flowered varieties of this plant are garden favourites, of easy culture, provided a very rich, friable, open soil is available; the soil should be heavily manured for a previous crop, and get an extra dressing of manure. The seed may be sown in lines six inches apart, and gradually thinned out as the plants grow until about six inches apart; by this time the first flowers will be seen; all inferior ones should be pulled out, a dressing of manure turned in between the remaining plants, and watered liberally if the weather is dry, using liquid manure twice a week. If good plants are still crowded, remove sufficient to give the remainder plenty of room; the plants removed may be potted or planted in another bed. Save seed from flowers open between November and February, when the wild varieties are not in bloom. A garden may be kept gay almost throughout the year with balsams only. Sow at intervals of fifteen days, from May to January; two months from sowing the plants are in perfection.

IMPATIENS SULTANA is a glabrous, erect branched, rather succulent perennial herb, having bright scarlet flowers with spreading petals. In our conservatories it is a really beautiful object, thriving among foliage plants and ferns, and enlivening the moist conservatory greatly.

IMPATIENS HAWKERII has large, deep carmine flowers with a white eye.

IMPATIENS MARIANA, from Assam, is a beautiful plant for the moist conservatory; it is white all over the leaf, except on the large veins, which are green, and the general effect of a plant among green foliage is very fine. Propagation by cuttings.

IMPATIENS OLIVERII, from Central Africa, forms a large bush, and the flowers recall the *Miltonia* orchid in size and colour, being 2 inches diameter, and of pale rose colour. It may be grown from seed or cuttings, and needs a cool moist conservatory, such as 2,000 to 4,000 feet altitude.

IMPATIENS ACAULIS—*The Stemless Balsam*.—This balsam has bright pink flowers up to 3½ inches in width while fresh, and grows on the face of a rock with north-west exposure, and water trickling over it, at an altitude of 2,000 feet on the Vingurla-Belgaum Road. A similar position may be found in some gardens, and the probabilities from cross-breeding with this fine species are extensive.

IMPATIENS NATANS—*Nir-Ganaru, The Water Balsam*.—An elegant floating annual having hollow floating and rooting stems, with erect five-sided branches; alternate sessile, serrate, lanceolate leaves; and large parti-coloured flowers with red, white, and yellow tints on 2-3-forked stalks. It may be sown in the mud at the margin of a pond.

OXALIS—*Amrool, Chukrika*.—Several species of this genus are lovely little plants with trefoil or quadrifoil leaves, folding downwards at night. The flowers are of many tints of rose, yellow, or white; and any light rich soil with plenty of water during the rains, and none during the dry season, is suitable. Propagate by separating the bulbs.

OXALIS CRENATA¹—*The Oka of Peru*—has a tuberous root of delicious flavour, and might be cultivated at some dry climate hill stations with success.

Many of the species make pretty basket plants, if a porous pot without a hole in the bottom be inserted in the soil.

TROPÆOLUM MINUS.²—In districts of scanty rainfall if sown in June or July and in November and December, and in moist districts at the latter season only, on a

¹ *Oxalis*, from the acid in sorrel, oxalic acid, discovered in this genus; *crenata*, having indentures between divisions.

² *Tropæolum*, from *tropiaon*, a trophy, the leaves being of the form of a buckler, and the flowers resemble an empty helmet. *Minus*, the smaller.

bed of rich well-drained earth, watered sufficiently to keep the soil moist, makes a very showy bed; it is better to avoid transplanting. The seed may be sown in lines six inches apart, and thinned if in danger of crowding.

TROPÆOLUM MAJUS¹—*The Climbing Nasturtium*—should be sown near the end of the rainy season; it thrives at hill stations better than in the plains, and the flowers emit flashes of light on warm evenings at twilight.

TROPÆOLUM ADUNCUM²—*Canary Creeper*.—This is a very pretty climber, attaining 8 feet in height, and specially adapted for training round a window, as it forms a charming frame, only needing a pretty face to make the picture complete. The seed should be sown about October, where it is wanted to bloom, on a rich loamy soil, and not exposed to the south.

TILIACEÆ,³ *The Jute Family*,

Are members of the Mallow group distinguished by free stamens.

CORCHORUS OLITORIUS—*Pat, Patta, Nurka*.—Distinguished from the following by its cylindrical five-celled capsules, and **CORCHORUS CAPSULARIS**,⁴ *Ghinalta pat*, with globular five-celled capsules, are interesting as the source of the valuable fibre jute, which is grown in Bengal during the rainy season. When in a young state, those species are occasionally used as pot herbs, and should have a place in a corner of the garden where water is abundant. At Vingorla they are to be found growing within reach of the sea water.

¹ *Majus*, the greater.

² *Aduncum* = crooked.

³ *Tiliaceæ*, from the old Latin name for the lime tree of Europe.

⁴ *Corchorus*, a Greek name for a pot herb, from *koreo*, to purge, and *kore*, the pupil; *capsularis*, bearing capsules.

ERINOCARPUS NIMMONII—*Chaora, Cher*.—A small tree with orbicular 5-7-lobed leaves and yellow flowers, about 2 inches in expansion in panicles at the ends of the branches during the cold season, succeeded by three-winged, prickly, woody fruit. This small tree is adapted for a district with heavy rainfall.

GREWIA ASIATICA¹—*Phulsee, Phulsa*.—A small sub-acid fruit of agreeable quality, useful in preparing cooling drinks during the hot season. Any ordinary garden soil watered occasionally is suitable. In pruning, cut the long shoots well in after the crop is gathered. Propagation of the best sorts is done by layering.

GREWIA TILIAEFOLIA²—*Dhaman, Dhamin, Pharsa, Thadsal*.—A very handsome tree, with luxuriant foliage, and producing numerous yellow flowers about $\frac{1}{2}$ inch in diameter. It is of special use on the outskirts of the garden as a source of timber for handles to hoes and such like tools: for this purpose branches of suitable thickness should be cut and laid up in store to dry, and when seasoned, it will be found strong and elastic.

ELÆOCARPUS EDULIS³—A small tree of New Guinea. Has been tried in Ceylon and found to thrive, says Mr. Macmillan, below 2,000 feet altitude. Its fruit is bright red, 3-5-angled—seeded oval and 2 inches in length, and used in jelly or pickling.

ELÆOCARPUS SERRATUS⁴—*Julpai, Verula, Perimkara*.—This small tree bears the fruit known as Wild Olive, and grows freely without special culture in moist districts.

ELÆOCARPUS GANITRUS⁵—*Rudraksa, Rudrakh*.—An interesting tree found in moist southern districts, and yielding beads worn by fakirs.

¹ *Grewia*, after Grew, an English physician; *Asiatica*, from Asia.

² *Tiliaefolia*, having leaves like *Tilia*.

³ *Elæocarpus*, having fruit like the olive; *edulis*, eatable.

⁴ *Serratus*, like a saw.

⁵ *Ganitrus*, brightened.

ELÆOCARPUS TUBERCULATUS¹—*Rudrak*.—Has an oval smooth drupe enclosing a compressed nut much tubercled on the flat sides, which is mounted in gold, and worn as an ornament. The tree is native in Travancore, and grows freely in gardens in moist districts.

LINEÆ, *The Linseed Family.*

A section of the Mallow group, including—

LINUM USITATISSIMUM²—Flax, Linseed, *Jowus*, *Ulse*, *Tisi Mashina*, *Utusee*—is a pretty plant, in India growing about 15 inches high, with a slender stem, and bell-shaped blue flowers. Although a field crop, it may be grown in the garden by one seeking only the satisfaction which bright colour brings, but in the possibility of obtaining improved kinds and the educational value of such objects, quite sufficient reason will be found for giving this modest plant a place in the garden. It may be sown any time between the beginning of September and the end of November in a deep, friable soil; two or three good waterings at intervals of ten days in dry weather are sufficient. In some parts of Europe this plant is sown thickly, grows about 3 feet high, and flax, the basis of linen cloth, is prepared from the inner bark. In Deccan it remains dwarf, but yields abundant seed.

ERYTHROXYLUM COCA.³—The Coca, a masticatory used in South America, grows freely in Indian gardens. It is a shrub of upright, bushy habit with alternate entire ovate leaves about 1½ inches in length and small, greenish-white flowers. It thrives if planted in rich loam in a sheltered position and watered enough to keep the soil moist. Propagation may be effected by cuttings, planted

¹ *Tuberculatus*, in small prominences.

² *Linum*, from *Linon*, the old Greek name used by Theophrastus. *Usitatissimum*, most useful.

³ *Erythroxylum*, red wood. *Coca*, the South American name.

in a propagating frame. The proportion of crude alkaloid obtained from Coca grown in Cachar—1·3 to 1·6 per per cent., and its physiological action—appears to be more active than cocaine from other sources.—*Pharm. Indica*, iii. 133.

LIMUM GRANDIFLORUM.¹—An annual with bright crimson flowers. Sow in October on a deep friable soil and do not transplant. Water thoroughly once a week and save seed when ripe.

REINWARDIA TRIGYNA²—*Gool ashruf, Abai*.—An undershrub, leaves 3 inches by 1, and bright yellow flowers 1 inch in diameter, having from three to seven styles which are long or short, and have variable relations to the length of the stamens, of value in cross fertilisation. The plant is propagated by division, and requires no special culture. At the margin of a shrubbery it is highly ornamental during the cold season.

MALPIGHIACEÆ,³ *The Huladvel Family,*

Are shrubs or climbing plants, of which a few are very striking ornaments of our gardens.

STIGMAPHYLLON PERIPLOCIFOLIUM.⁴—An elegant climber, whether in blossom or not, growing freely from cuttings in any ordinary garden soil freely watered and well drained.

HETEROPTERIS PLATYPTERA⁵—*Banisteria longifolia*—is a choice climbing shrub with rigid, oblong,

¹ *Grandiflorum*, large-flowered.

² *Reinwardia*, name after R. G. R. Reinward, Director of the Botanical Garden at Leyden. *Trigyna*, having the ovary with three divisions.

³ *Malpighiaceæ*, from the genus *Malpighia*, after Malpighi, once a Professor of Medicine at Pisa.

⁴ *Stigmaphyllon*, having a leaf-like stigma. *Periplocifolium*, in allusion to the stalk being inserted within the margin of some of the leaves and presenting no obstacle in going round.

⁵ *Heteropteris*, variously winged. *Platyptera*, broad winged.

entire leaves; while young, of a bronze colour and furnished with spreading hairs, which are attached by a very short stalk in the centre; flowers bright yellow, much resembling the above.

MALPIGHIA COCCIGERA,¹ is a small shrub, with crowded spiny leaves and small, pinkish flowers produced in great profusion; during October–December; it is of slow growth and very ornamental; the northern side of a house or a tree suits it, with ordinary garden soil and occasional watering in dry weather. Propagated by cuttings in a frame.

GALPHIMIA GLAUCA.²—A shrub 3 to 4 feet in height, of upright habit and having opposite entire leaves and small racemes of bright yellow flowers terminating the branches. At Poona it remains in bloom during August–February. Its tidy habit of growth makes it excellent for internal fencing where the climate approaches that of Poona. Propagate by seed.

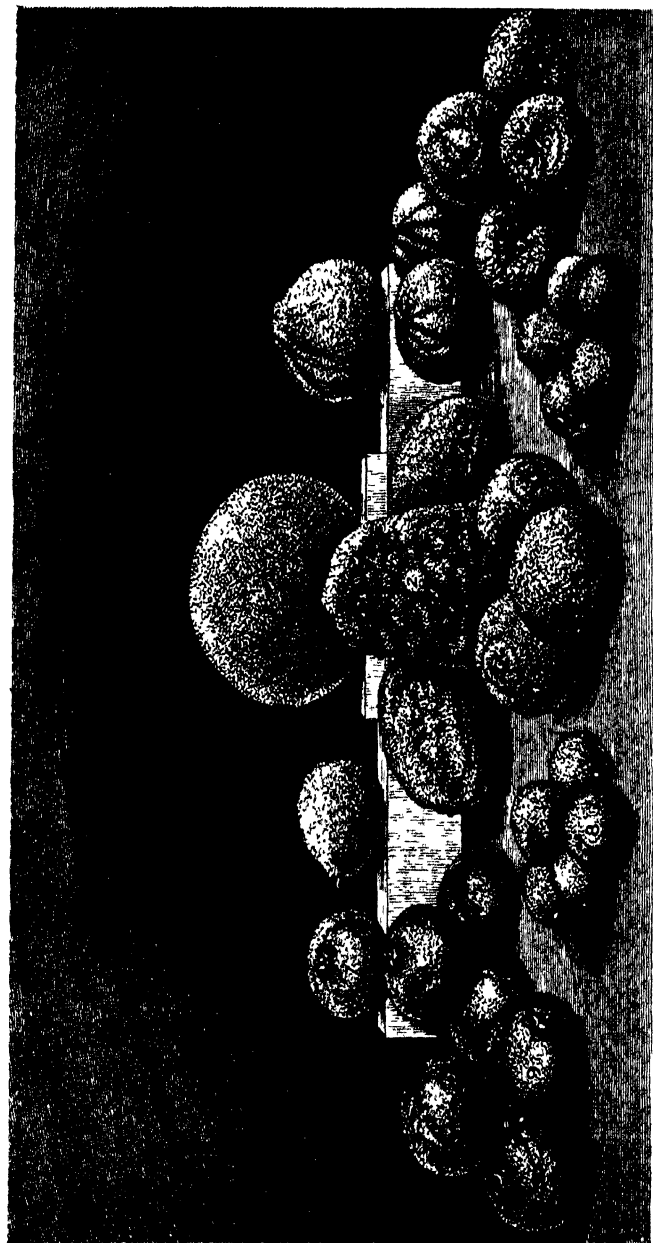
TRISTELLATEIA AUSTRALIS.³—A slow-growing climbing shrub having showy yellow flowers succeeded by fruit consisting of three star-shaped carpels, from which its name is derived. It flowers freely in the climate of Poona when grown as a pot plant fully exposed and regularly watered. Propagate by seed and layers.

HIPTAGE MADABLOTA—*Mudhumalatee*.—A climbing shrub having opposite, entire, elliptical-pointed, smooth leaves, averaging 5 by 2½ inches, on stalks ½ inch in length, and having a pair of black glands at the base of the leaf. The flowers have honey perfume, and are produced during the months August to January. Each flower has 5 shortly stalked, fringed petals—4 white, 1 golden. The fruit consists of 3 nuts, each having 3 to

¹ *Coccifera*, having berry-like fruit.

² *Galphimia*, an anagram of *Malpighia*; *glauca*, bluish grey.

³ *Australis*, southern.



GROUP OF THE ORANGE AND CITRON TRIBE AT POONA, IN NOVEMBER.

- | | | |
|---|--|--|
| No. 1. Pamelio, <i>Popanus</i> . | No. 5. Mozambique Grange, <i>Mozambi</i> . | No. 8. Lime, <i>Nimbu</i> . |
| " 2. Bitter Citron, <i>Maloongi</i> . | " 6. Kowla Orange, <i>Kowla</i> . | " 9. Cintra Orange, <i>Cintra</i> , <i>Sunktaa</i> |
| " 3 and 4. Acid Citron, <i>Jamboori</i> . | " 7. Ladoo Orange, <i>Ladu</i> . | |

4 wings. This climber thrives with little care, especially on the northern side of a house, and is propagated by seed or layers.

MALPIGHIA GLABRA¹—*The Barbadoes Cherry*.—A small West Indian fruit tree with rose or purple flowers, in peduncled cymes half the length of the leaves, a round red pulpy fruit and opposite ovate pointed leaves 3 feet by 1½ feet; is cultivated at Gwalior.

RUTACEÆ, *The Rue and Orange Family*,

Consists of trees and shrubs with compound leaves furnished with glands filled with essential oil, which gives a characteristic odour to the various members of the family. A rapid loss of germinating power in the seed is common in this family, therefore it is advisable to sow seeds when freshly gathered.

ORANGE TREE, *Citrus aurantium*,² *Narangi*, *Kattale*, *Peni-dhoclan*, *Narran-kai*.

The varieties have distinct vernacular names, which are noticed later.

The Orange has developed several distinct races:—

- I. JAFFA, an elongated, lemon-shaped fruit;
- II. NAGPUR, and JAPANESE, with loose skin;
- III. MALTA, ST. MICHAELS, MOZAMBIQUE, KOWLA, and BITTER SEVILLE, having a circular mark at the stigmatic end;
- IV. MANDARINE, TANGERINE, BLOOD, and RESEMI are small oblate oranges with abundant seeds.
- V. SYLHET.

¹ *Glabra*, smooth.

² *Citrus*, from the Greek *kitron*. *Aurantium*, golden.

The climate desirable for orange cultivation is indicated by the success attained in the basin of the Mediterranean, in Florida, and the Khasia Hills, in Assam, which have a mean yearly shade temperature of about 65° F., with a minimum of 40° F., and are described as sub-tropical ; but, with simple precautions, good fruit may be produced in climates differing greatly from the most desirable. At Nagpur, where oranges of very high quality are produced, the altitude is 1,025 feet, the yearly mean shade temperature 78° F. nearly, the maximum being 116° F. and the minimum 47° F. In Ceylon and Southern India suitable climates occur from about 2,500 feet to 5,000 feet altitude, much depending on aspect and other local conditions, and as we progress northwards the necessary altitude falls proportionately.

Soil.—A deep alluvial loam, which does not crack deeply in dry weather, is well drained, and in addition to the essential soluble phosphoric acid and potash, contains 5%–10% of lime, is desirable, the higher proportion being necessary where the lime is in nodules, as *kunkar*. Shelter from hot wind is desirable, but large trees or bambus must not be planted near the orange trees so that the roots of the shelter trees may run through the highly tilled soil of the orange plot and compete for the mineral plant food.

Water Supply for Orange Cultivation.—The Khasai Hills country, in which the Sylhet Orange is cultivated, is a decidedly wet region, the highest recorded rainfall being in that country ; and, as recorded by Dr. Bonavia, the orange plantations are sometimes flooded to a depth of 4–6 feet, special houses of refuge being erected on posts, in which the people, with the poultry and pigs, may escape the deluge. At Nagpur, the mean yearly rainfall is 44·5 inches yearly, and irrigation to the extent of 2 inches monthly is used during the dry season to such trees as are bearing a crop. Trees at rest are, of course, kept comparatively dry, and young trees newly

planted require 1 inch of water every three days until they have taken root.

Raising Orange Trees.—Orange trees in large plantations of one kind are in the same position as plants of wheat or rice in a field—the pollen of one plant fecundates the ovules of another, hence the fruit and seed become uniform and the plants raised therefrom bear fruit of uniform quality. In the orange this quality is satisfactory, and in the Khasia Hills district and Florida, trees raised directly from seed without grafting (*seedlings*) bear satisfactory fruit and are considered more vigorous than grafted ones; but where oranges are not so much of a speciality, and a variety of sorts are cultivated which would cross-fertilise each other, it is found advantageous to graft the select sorts.

For grafting the orange tree, “budding” is employed (for details, see page 41). In budding the orange, extra care is necessary to prevent the cross cut from going too deep—it should be through the bark only, otherwise the flow of sap is arrested and a cicatrix forms, which is injurious. Native grafters have an ingenious method of avoiding this; they make only one slit—the vertical one—and by bending the stock over towards the cut make it gape open. The bud is then slipped into the gap, and the stock being released, it springs up, holding the bud in its place; a slight bandage with *sopat* is then applied. The operation may be performed between June and January. The stock used is a vigorous citron named *Jumburi* or *Jumbira*, but any vigorous orange is suitable, and that any benefit is obtained by using the sweet lime as a stock is now considered mythical.

To raise “Stocks” for the Orange.—During the months of October to December, *Jumburi* fruit is obtainable. Select such as has ripened on the tree and let the seed remain in the fruit till wanted for sowing. Prepare a rich, friable seed-bed, and plant the seeds 6 inches apart. Germination proceeds very soon, and a

few weeks later, when the first growth has become firm, it may be well to transplant 1 foot apart, in lines 2 feet apart. In northern districts, the seed-bed may remain undisturbed till the monsoon has set in, but under favourable conditions the stocks are 3 feet in height in the following July or August, and are ready to bud. It is necessary to be very careful regarding the source of the buds used in grafting, because inferior qualities require as much expenditure as the best sorts. Buds for grafting purposes may be carried by post a long distance if packed with damp leaf-mould or sawdust.

To make a Plantation of Orange Trees, the soil should be enriched with a heavy dressing of street sweepings and cow-dung, which have been kept in a moist pit for some months, and spread on the surface 2 inches deep. The soil should then be dug or trenched 18 inches deep and arranged for irrigation, and a crop of cauliflower, potatoes, or some crop of that nature planted, which will repay the heavy manuring and digging. The young grafted orange trees should be set in straight lines 10 feet apart among the other crop, and carefully watched during the first year or two to see that shoots do not come from below the graft; if any appear, they must be rubbed off. Where the rainfall occurs throughout the year, as in the Khasia Hills, and irrigation is unnecessary, 15 feet apart is more suitable. The ground should be carefully worked with a variety of crops needing irrigation during the first five years, while the orange trees are gradually occupying the soil.

Mr. Mahaluxmivalla, who had special opportunity of observing the practice so successful at Nagpur, says:—“Assuming that we have established trees five or more years from the graft, in March watering is gradually lessened and is completely stopped by the middle of May. The earth is then opened up round the roots, manure (well decayed bullock or cow-dung) is heavily applied (3 inches in depth), and the roots covered up with fresh soil. All the leaves now drop off, and at the

beginning of the monsoon (or earlier if the trees are artificially watered, as is sometimes done) the tree is full of flowers and new young leaves; this is the *mirag bahar*, or first rain flowering, at the end of June. The fruit from this flowering ripens between February and May, and is the finer of the two seasons'.

"A second flowering takes place nearly at the same time as the mango tree flowers, in February and March, and is called the *ambia bahar*. The fruit from this flowering ripens from December to February. For this crop the resting and manuring is done in December."

It is not advisable to let the same tree carry both crops, because it would interfere with the hot season resting and exhaust the tree.

In the Khasia Hills, where the Sylhet orange is grown, plants are raised from seed, and when about three years old and 4 feet in height, are planted obliquely, so that instead of one erect stem, three or four stems are developed, and the yield of fruit is proportionate.

Pruning.—Little pruning is necessary for orange trees, but weakly or dead shoots should be cut out, and extra luxuriant shoots have the tip taken off to keep the tree in a regular shape and cause an equal distribution of the sap.

INSECT ENEMIES OF THE ORANGE TREE.

A boring grub, which gives evidence of its presence by sawdust-like chips joined together by spider-web fibres, may be dislodged by squirting kerosene into its hole.

The larva of *Papilis erithronius*—one of the Swallow-tail Butterflies—destroys the young leaves in July. It is described by Captain Hutton as—"Green, with a reddish or orange-coloured head; the fourth segment of the body is bordered by the same colour, and there is a lateral oblique strip on the hinder parts, which is blackish and edged with white; the spiracles are black; there are two short tentacular horns projecting from the

anterior segment, beneath which is a whitish stripe, running obliquely forwards and downwards; and a white lateral stripe above the legs, which are yellowish." When the caterpillar is seized with a pair of pliers, it instantly projects a pair of processes, having the scent of rotten oranges. The larva may be caught and thrown into *gumela* having a fresh coating of tar.

"*Scale*" of several species is destructive to the orange tree. *Aspinotus ficus* is virulent at Khandala W. Ghats, and may be treated with the rosin wash described at page 80.

VARIETIES OF ORANGE AND LIME CULTIVATED IN INDIA.

The "LADOO" ORANGE OF THE DECCAN.—Often gathered half-grown for use in confectionery. Shape, a much depressed sphere with a distinct papilla at the stalk; skin, moderately rough and loose, of dusky yellow colour and medium thickness; inner skin, very thin and enclosing juicy sweet pulp of piquent flavour; in colour, of the medium tint that may be called the typical colour of orange pulp, being the same as "St. Michael's" and "Cintra," and several shades darker than "Malta" and "Mozambique," and lighter than "Kowla." A fine orange, not popular on account of the indifferent appearance of its skin, but its pulp is finer than that of its showy relative, the "Mandarine." A remarkable malformation occurs in many of the fruits of this variety; at the stigma end, within the skin, an extra orange—as large as a marble, distinctly formed, with five to seven carpels—may be found. Leaves, from $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. to $2\frac{1}{2}$ in. by $1\frac{1}{4}$ in., with the winged joint very slightly developed, as in "Cintra," "Kowla," and "Meeta Limboo." Flowers, five petals $\frac{3}{4}$ in. in diameter: stamens, twenty to twenty-four; carpels, nine to ten. The *habit* of the tree is large, straight branches, as in "Citra" and "Kowla," but spreading more than in those varieties.

“CINTRA” ORANGE—*Loose-skinned* (No. 9 in illustration, page 212).—From the name, this orange has long been assumed to be of Portuguese origin, but Bonavia contends that it is a corruption of a Sanskrit word, and should be spelt *Suntura*. However, Dr. Dymock, whose knowledge of Oriental languages was extensive, retains the derivation from the Portuguese valley Cintra. It is undoubtedly the finest orange in cultivation in India, and the fact that it flowers at two distinct seasons—January and July—and will ripen fruit accordingly, would seem to point to some other climate than the plains of India as its original home; but if permitted to bear two crops of fruit, neither attains perfection, and the chief advantage the Nagpur cultivators have in growing this orange is the habit of setting some brakes of the tree to rest in November and others in March, thereby ensuring one good crop from each brake instead of two imperfect crops. The fruit is to be found 10 ozs. in weight, but ordinary specimens weigh about 7 ozs. The skin is smooth; in one variety very loose, in another tightly fitting the pulp. The loose-skinned variety has a corrugated nipple rising from a circular depression on the stalk end, and the stigmatic end depressed and rougher than the sides. Carpels, nine to ten; inner skin, thin; seeds, generally twenty, but in the finer specimens only two or three; pulp, sweet and typical colour. Flowers and leaves as in “Ladoo.”

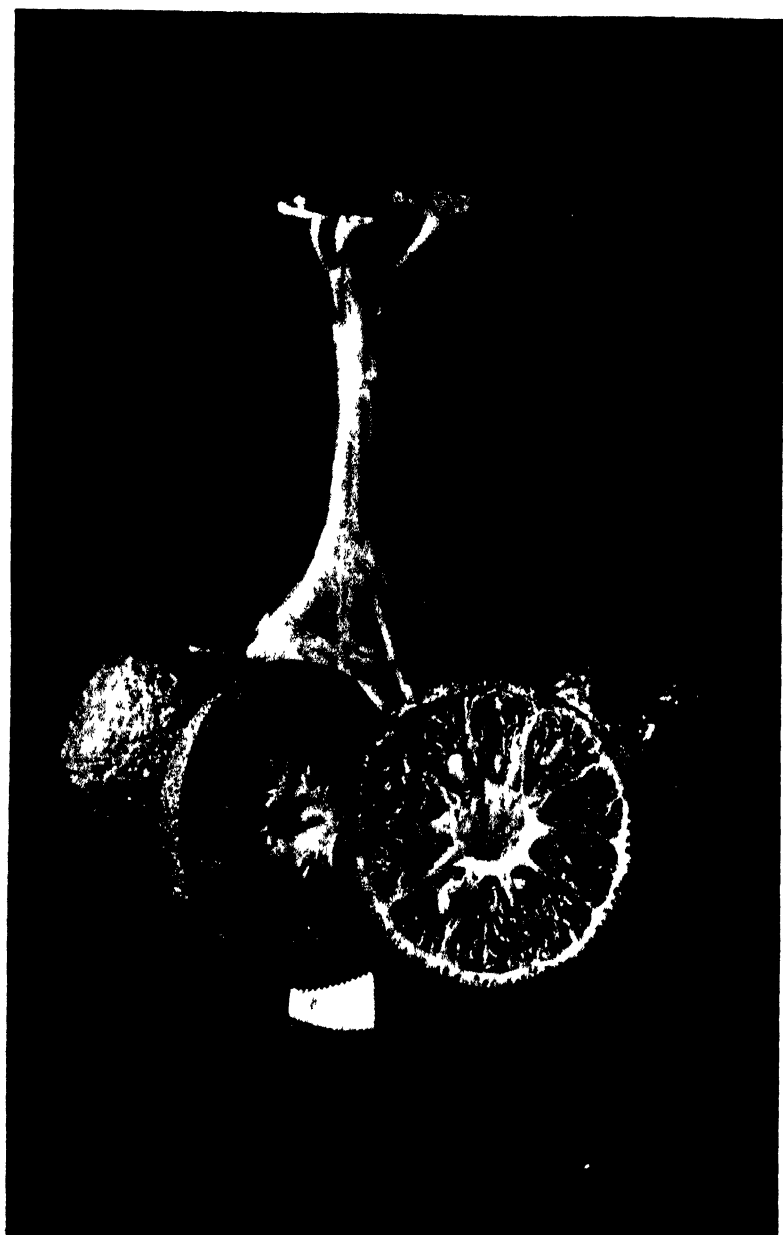
KOWLA ORANGE (No. 6 in illustration, page 212).—This tree resembles “Cintra,” yet the fruit is very different. Average weight, 6 ozs.; becomes yellow on the tree before it is sweet, and therefore called *teeka pukka*. Skin, dark orange when ripe, rough, with several irregular vertical ridges, and a circular channel enclosing a space one inch in diameter containing raised irregular papillæ on the stigma end. Carpels, ten; inner skin, strong; and the pulp of a deep orange colour. An indifferent dessert fruit.

MANDARINE ORANGE, as found in the Deccan—*Lall Ladoo*.—Average weight, 7 ounces; form, a depressed sphere, with slight papilla at the stalk and a hollow on the stigmatic end; skin, smooth polished, with small regular punctures, loose, and of a deep orange colour; inner skin, of medium strength, the juice cells separating freely; pulp of medium colour (a brownish yellow); flavour, very good. Leaves and habit as in “Ladoo.” Flowers—carpels, eleven; seeds on average, twenty. Cultivated generally in the Deccan and at Lucknow, In season, November to January. A handsome fruit, with its bright colour and regular form, but with a stronger inner skin and inferior in flavour to its plain-looking sister “Ladoo.”

MOZAMBIQUE ORANGE—variety *Khaguzee* (No. 5 in illustration, page 212).—Average weight, 10 ozs., though specimens weighing 13 ozs. are plentiful; shape, globular, slightly compressed vertically; skin, medium thickness, tight, marked by numerous vertical furrows and a distinct circular, smooth mark 1 inch in diameter on the stigmatic end; pulp, generally pale yellow, but when fully ripe of the normal brownish-yellow tint; inner skin, strong, so that the orange can only be sucked; juice, sweet, but without piquancy. The leaves are from $2\frac{1}{2}$ by $1\frac{1}{4}$ inches to $5\frac{1}{2}$ by $3\frac{1}{4}$ inches, entire or very slightly serrate; apex, acuminate or emarginate; petiole, $\frac{3}{4}$ inch; the winged joint attaining $\frac{1}{4}$ inch in width, often less, and in some of the larger leaves wanting. Flowers, $1\frac{1}{2}$ inches in diameter, of five slightly oblique petals, glandular on the outside. Stamens, twenty to twenty-four.

MOZAMBIQUE ORANGE—variety *Goradiya*—is the same as the above, except that the skin is thicker.

The ST. MICHAEL'S ORANGE.—Globular in form and averaging 7 ozs. in weight; moderately smooth; thick tight skin; carpels, ten to twelve; pulp of medium orange hue; sweet; centre full of pith; leaves, from $1\frac{3}{4}$ by $\frac{3}{4}$ inches to 3 by $1\frac{1}{2}$ inches; quite entire. Cultivated at Mopani, Central Provinces.



THE SYLHET ORANGE
(Half natural size)

MALTA ORANGE.—Shape, globular, large; average weight, 10 ozs.; skin, medium smooth, green or pale yellow when ripe; thick inner skin; strong flesh, pale orange, sweet. It is much grown at Lucknow, and plants are procurable from that station. This and the “Mozambique” are closely allied, if not identical; the foliage and growth are similar.

SYLHET ORANGE. Shape, oblate spheroid; size, $2\frac{1}{2}$ by 3 inches; weight, 5 ozs.; carpels, ten, separating in centre; seeds numerous; skin, thin, with little white pulp, medium smoothness, deep orange when ripe; inner skin, tough; pulp, deep orange; flavour, watery. Seed with several embryos.

JAMAICA ORANGE.—Shape, spherical; diameter $2\frac{1}{2}$ to 3 inches; weight, 4 to 8 oz.; seeds, twelve; inner skin delicate; skin, medium thickness, smooth, pale orange, similar to the “Jaffa”; pulp, medium orange; flavour delicious. Seed with several embryos. A very superior variety.

The JAMAICA ORANGE, “RED STAR” BRAND, is very similar to the “Sylhet”—in short, it is the “Sylhet” grown in the Jamaica mountains, with slightly thicker adhering skin and more sweetness.

TANGERINE ORANGE—*Resemi narangi*.—Fruit averages 3 ozs. in weight; form, oblate sphere; skin, loose, thick in proportion to the size of the fruit; colour, deep orange; pulp, sweet, but sparse and full of seeds; carpels, ten to twelve; seeds, average twenty. Habit, a dwarf, very ramous tree, resembling the *Khaguzee Limboo*. A poor orange, the seeds occupy nearly the whole of the little carpels. Cultivated at Poona and Sheveroy Hills.

BITTER SEVILLE ORANGES.—Average 7 ozs. in weight; skin, smooth, thick, very pithy on the inside and marked on the stigmatic end by a circle about an inch in diameter, resembling the mark found on the “Mozambique”; pulp, pale yellow; juice, copious, but

acid. Leaves, $3\frac{1}{2}$ by 2 inches; petiole, 1 inch; the winged joint slightly developed. Cultivated above 4,000 feet altitude, and used in the preparation of marmalade.

BERGAMOTTE ORANGE—of Calabria, South Italy—is pear-shaped, and has a strong perfume in its rind, which is cultivated in its native district. It will grow in any situation in which the common orange thrives.

MANDARINE ORANGE AT LAHORE.—Form, oblate sphere, 2 in. wide by $1\frac{1}{2}$ in. deep, with circular depressed mark on apex; skin, deep orange, medium thickness; carpels, about ten; seeds, two in each carpel or segment, with several embryos. Habit, small diffuse tree, profuse bearer, with several embryos.

“ORANGE DE CALABRIA,” Lahore.—Form, nearly perfect sphere, $3\frac{1}{2}$ in. in diameter; skin, orange, medium in roughness and thickness; carpels, thirteen; seeds with several embryos, many imperfect; colour of pulp, deep; flavour fine; juice abundant.

“SZ-IN-KOM”—a Chinese orange at Saharunpore.—Form, depressed sphere; size, medium; colour, orange; skin, medium rough, loose; carpels, fourteen; seeds, several; colour of pulp, medium; of superior flavour. A superior “Mandarine” orange.

“NAVEL”—California, Riverside Heights, No. 10.—Form, globular or oval, with an extra orange inside at the stigmatic end; weight, 9 ozs; colour, typical orange; skin, medium smoothness, thick; carpels, thirteen.

BLOOD.—Like “Tangerine,” but with pulp and juice blood red.

“NAARTJCE” is a South African Orange very near to the “Tangerine,” and fit for preparing marmalade. Weight, $1\frac{3}{4}$ ozs.; skin, rough reddish orange colour, with a nipple at the stalk; form, oblate sphere; carpels, ten; seeds, twelve; embryos, several. Therefore a true orange. Flesh, deep orange yellow; flavour rich.

Oranges Examined at Glasgow.

VALENTIA.—Weight, 5 ozs.; form, nearly globular; colour, orange; surface, minutely raised, glandular, at base three to six depressed lines $\frac{1}{2}$ in. long; skin, thick, closely attached, white part thick; inner skin, strong; pulp, sweet, medium coloured; seeds, about twelve, large, polyembryonic.

TANGERINE.—Size, 2 in. by $1\frac{1}{2}$ in.; weight, 2 ozs.; form, oblate sphere; colour, orange, slightly deep; surface, minutely raised but with large distinct oil glands; base with persistent calyx protruding or depressed; apex slightly depressed, with three to six short radiating channels; skin, thin, white wanting; carpels, eleven; inner skin, weak; pulp, sweet, deep coloured; seeds, four to twenty, large, polyembryonic.

JAFFA. —Size, $3\frac{1}{2}$ by 3 in.; weight, $7\frac{1}{2}$ ozs.; form, oval; colour, pale orange; surface, wrinkled at base, smooth upward; skin, thick, at base $\frac{3}{16}$ in., reducing upwards; inner skin, thin; pulp, pale, sweet; seeds, polyembryonic, few.

BITTER -for marmalade.—Size, 3 in. by $2\frac{1}{2}$ in.; weight, $6\frac{1}{4}$ ozs.; form, oblate sphere, base intruded; colour, deep orange; surface, slightly rough, apex with a circular mark $1\frac{1}{4}$ in. diameter; skin, $\frac{1}{4}$ in., firm; inner skin, strong; pulp, pale, very acid; seeds, about thirty, large, polyembryonic, few. Insertion of stalk, $\frac{1}{2}$ in. in width, much larger than on other oranges.

MALOONI—*Cholonga, Chakotra, Citrus medica* (No. 2 in illustration, page 212).—A low-spreading shrub bearing purple tinged flowers larger than other species and fruit attaining 4 lbs. in weight, of an oblong shape, irregularly ridged and wrinkled; the surface smooth, with prominent convex oil glands and a small papilla at the stigmatic end. The skin, $1\frac{1}{2}$ inches in thickness,

is firm and solid, enclosing ten carpels having a pale coloured pulp between very strong endocarpal layers, and with scanty bitter acid juice and about a hundred seeds, which are small in proportion to the size of the fruit, but generally contain several embryos, as in many other seeds of this genus. The *Maloongi* is excessively variable in size, form, and surface of skin; very smooth and also rough-skinned specimens may be seen on the same tree at one time. A tree of this kind, bearing fruit of enormous size, was to be seen in Kew Gardens in 1902.

JUMBURI or JAMBIRA—the *Citron*—is probably the original form of *Citrus medica*. It is a vigorous tree, bearing fruit in abundance, which averages 4 inches in length by 3 in transverse diameter, and has a rough skin and abundant acid juice, which is used by dyers. This tree is widely used as a stock upon which to graft the orange, and serves the purpose admirably.

MUSCAT LIME—in Bombay Market.—An egg-shaped fruit weighing $\frac{1}{10}$ lb., and having a very thin, smooth, yellow rind, enclosing eleven carpels with pale pulp. Sweet, but without piquancy. The inner skin is tough, and the numerous seeds have only one embryo. This fruit is evidently imported, and its seeds are interesting from the single embryo, which, in the cultivated species of *citrus*, is peculiar to the pumalo and lime, as far as the author has observed.

MALTA LEMON—or Saharempore—has leaves up to 6 by $3\frac{1}{2}$ inches, irregularly crenate, without wings, on the $\frac{1}{2}$ -inch stalk, and fruit $3\frac{1}{2}$ by $2\frac{1}{2}$ inches, with a distinct nipple at the apex. The pulp has a lemon colour and flavour.

CARDAMON LIME—a variety from Italy—have the flavour of Cardamon. The leaves attain $4\frac{1}{2}$ by 3 inches, and the fruit is spherical, $2\frac{1}{2}$ inches in diameter, with a nipple. Is cultivated at Saharempore.

The SWEET LIME—*Meta Limboo* or *Sakar Limbo*.—Average weight, 6 ozs.; form, globular, sometimes extending vertically. Skin very thin, tight, smooth, and of a greenish yellow and ultimately pale yellow. Carpels, eleven to twelve; seeds average ten, paler than orange seeds and with several embryo; pulp very pale in colour and abounding in a sweet insipid juice. Leaves up to $3\frac{1}{2}$ by $2\frac{1}{4}$ inches; petiole up to $\frac{1}{2}$ inch; slightly and irregularly serrate crenate; thorns $\frac{1}{4}$ inch.

LEMON-SHAPED LIME—*Pati nimboo*, *Karna*. Fruit oval, $3\frac{1}{2}$ ounces in weight; $2\frac{1}{4}$ to 3 inches by $1\frac{1}{4}$ inches; apex and base with papilæ; skin smooth and yellow when ripe; juice very acid and abundant; carpels, ten to twelve; seeds about twenty. Leaves, 2 by 1 inches to $2\frac{1}{2}$ by $1\frac{1}{4}$ inches; petiole, $\frac{1}{2}$ inch; the winged joint attaining $\frac{1}{4}$ inch. Flowers of four petals, $\frac{1}{4}$ inch in diameter, with twenty-two to twenty-five stamens. Habit, a vigorous-growing tree with spreading branches.

The LIME, or *Limbu*, of Bombay is a globular, smooth, pale yellow fruit weighing $\frac{1}{10}$ lb. It has ten or eleven carpels, with pale greenish yellow pulp of very pleasant acid flavour, and numerous seeds, having several embryos. The tree is dwarf, very much branched and thorny, and yields abundantly with ordinary garden treatment in districts where the monsoon is not excessive. It is usually propagated by seed.

CITRUS JAPONICA¹—*the Kumquat*.—This small species of lime is occasionally to be met with in botanical gardens, where it is desirable to grow specimens of every plant that can be cultivated either for use or ornament. In the plains it is very delicate, but at an altitude of 4,000 feet thrives freely. It may be propagated by budding on the small lime, *Kaghuzi Limbu*, or on the *Jumboori*.

¹ *Japonica*, from Japan.

CLAUSENA WAMPI¹—*the Wampi Fruit*—has pinnate leaves of about seven ovate-lanceolate, acute leaflets, slightly unequal at the base, and panicles of small white flowers producing edible smooth yellow fruit as large as a pigeon's egg, and useful for preserves. At Calcutta and Poona the *Wampi* thrives in a loamy soil irrigated occasionally, and is propagated from fresh seed or layers.

THE PUMALO—*Paradise Apple, Shaddock, Popanus, Batavi niboo, Citrus decumana*² (No. 1 in illustration, page 212).—This beautiful tree, whether perfuming the air with its rich waxy flowers or gladdening the eye with its massive fruit, is one of the most striking and agreeable objects in the garden. The fruit attains 4 lbs. in weight and 7 inches in diameter, globular in form; skin smooth in comparison with others of its tribe, but roughened by the oil glands, and without other constant markings, from $\frac{1}{4}$ to 1 inch in thickness; carpels, fourteen to fifteen; pulp varying in colour from that of a common orange to a deep carmine; seed with only one embryo; leaves from $2\frac{1}{2}$ by $1\frac{1}{2}$ inches to 5 by $2\frac{1}{2}$ inches; petiole having the winged joint varying from $\frac{1}{8}$ inch to $1\frac{1}{2}$ inches in breadth. It thrives from near sea-level up to 3,000 feet altitude, or higher, as an ornamental tree.

In Salsette, where the highest quality of pumalo fruit is produced, the trees are grafted on seedling pumalo and fed on the strongest nitrogenous manures procurable, blood, fish, and other animal matter being freely used. A very fine specimen, evidently grown from seed, and having a clear stem 10 feet in height and a densely-branching head, grows on an islet in the river at Poona (1,800 feet altitude), which is covered during floods, and is only a few feet above the normal height of the water.

Pumalo delights in a rich porous soil and an ample supply of water, with thorough drainage. It is not

¹ *Clausena*, commemorative of P. Clausön, a Danish botanist of the seventeenth century. *Wampi*, the vernacular name.

² *Decumana*, huge.

necessary or desirable to dry up this tree to produce flowering, but, at the beginning of January, each tree should have a good supply of old manure dug in near its roots. It will flower freely during the cold season, and, again, at the beginning of the rainy season, a few flowers appearing at intervals between those seasons. A very fine-flavoured, seedless variety, named *Bae-danae*, occurs in Poona Gardens. The sorts named *Gorva*, *Káphi*, and *Bangáli* are highly esteemed, and the fruit of trees raised from seed has usually a pithy rind, 1 inch in thickness. The highest quality of pumalo fruit has flesh-coloured pulp and a rind $\frac{1}{2}$ inch in thickness.

Propagation is generally done by budding on the common citron, *Jumbooree*, a tree which yields a large coarse fruit that is used by dyers for the acid it contains; the seeding pumalo also makes a good stock. Very little pruning is required, but all weakly or decaying shoots should be cut out, and the bunches of fruit should be thinned out as soon as the pumaloes reach the size of marbles, till at most one fruit remains for each small branch; but if there are still more than one to each strong branch, it is advisable to thin out still further. To produce large specimens, the fruit should be supported, so that its weight may not bend down the branch and impede the flow of the sap.

THE GRAPE FRUIT. —The grape fruit is globular, from $\frac{1}{2}$ lb. to 1 lb. in weight, smooth, pale yellow outside, of a dozen carpels and several seeds. The seeds have several embryos like the orange, but the fruit in general resembles a small pumalo. Hence it is said to be a variety of *Citrus decumana*, but the important character in the seeds, *which certainly are not those of Citrus decumana, which has only one embryo*, is overlooked. It is presumed that the grape fruit is an accidental hybrid between the pumalo and the orange, of which the history, although recent, is unknown. The juice is abundant and pleasing, and is sure to become popular. The tree grows wherever the orange or the pumalo exists; that is in those inter-

mediate climates represented by 2,000 to 4,000 feet altitude in tropical countries.

RUTA GRAVEOLENS¹—*Rue, Sudal, Satur*—beyond ordinary soil and occasional watering, needs no special culture. Propagate by division and by seeds.

FERONIA² **ELEPHANTUM**—*Elephant or Wood Apple, Kowat, Kavut, Rathbel, Yellunga, Valunga*.—A handsome erect-growing tree, in a young state armed with strong, straight, axillary thorns, and bearing alternate leaves of five to seven leaflets, having minute oil glands, and smelling of aniseed. The fruit is the size of a cricket-ball, dull grey, and edible. This tree is of slow growth, but is suitable for roadside purposes if planted alternately with some quick-growing but short-lived tree. In planting this tree, a hole 4 feet deep should be prepared, the lower half filled with stones and sweepings, the upper, with good soil, and seed sown where the tree is wanted to remain, so as to avoid transplanting. To ripen properly, the fruit needs to be exposed to the sun during about ten to fifteen days after gathering.

BALANITES ROXBURGHII—*Hingota, Hingenbate*.—A small thorny tree widely distributed in dry districts. It thrives on very sandy or gravelly soil, and its thorns and branching habit makes it a good fence.

RAVENIA SPECTABILIS.³—A shrub with three-foliate leaves and rosy flowers. It grows nicely in moist districts, with slight shade. Propagated by fresh seeds or layers.

MURRAYA EXOTICA⁴—*Norga golunga, Kaminee*.—A very fine shrub with alternate, impari-pinnate leaves,

s, heavy-smelling.

² *Feronia*, after Feronia, a Roman goddess. ³ *Spectabilis*, worth seeing.

⁴ *Muraya*, named after John Andrew Murray, a Swedish botanist, 1740-1791. *Exotica*, exotic.

having five to seven leaflets, usually of a dark glossy green, throwing its pure white sweet-smelling flowers into relief during two seasons, one in December or January, and another at the beginning of the rainy season, as is common in this family. The foregoing describes a distinct variety of the species which is widely cultivated in gardens. Another form, with paler green leaves and larger leaflets, is abundant on the Western Ghats, where it is called *Kunti* and *Chula juti*. Seed of both varieties is produced abundantly by old plants in October, and if sown at once spring up at the end of December.

MURRAYA KÖENIGII—*Kadi-nim*.—A small tree with unequally pinnate, alternate leaves attaining 12 inches in length, and having eleven to fifteen leaflets about 2 by 1 inch, and yielding abundant white flowers the size of an 8-anna piece. The fruit is egg shaped, with a beak rough with glands, black, and two-seeded. The leaves, called *Karrie-pak*, are used to flavour curries. It is at home on the Western Ghats, thrives in gardens with ordinary treatment, and is propagated by seed.

TRIPHASIA AURANTIOLA—*Chin-ke-limbu*.—A spiny shrub with small, alternate, three-foliate, thick leaves, and small, white, odorous flowers, succeeded by fruit like a small lime, having a pleasant fragrance, and used in China preserves. The plant is used as a fence in the Riviera, and thrives in our gardens without special attention.

ÆGLE MARMELOS¹—*Bael*, *Bela maredoo*, *Willa maroum*.—On a deep soil, slightly irrigated while the tree is young, the *bael* forms a hardy small tree. The pulp of the fruit is a valuable remedy in dysentery, and the tree is well adapted for fences in open stony ground. Propagation is effected by seed.

¹ *Ægle*, one of the Hesperides. *Marmelos*, from *marmelo*, the quince.

SIMARUBACEÆ, *The Maruk Family*,

Is a group of trees with bitter bark, and is often of an imposing character from the large size of their leaves; the flowers are small, and usually have the sexes in distinct flowers.

AILANTUS GLANDULOSA.¹—A lofty tree from China, with alternate pinnate leaves, often 3 feet in length, on vigorous trees. The leaflets are large and coarsely toothed, and divided very unequally by the mid-rib. It grows nicely from 3,000 feet altitude upwards.

AILANTUS EXCELSA ²—*Maharuk, Máruk*—is a tree of the Deccan very closely resembling the above and thriving on rocky soil. A useful road-side tree, but not giving shelter during the cold season.

AILANTUS MALIBARICA—*Hem-mara, Ood, Perumaram, Pedu-manu*—has very grand foliage and grows naturally from Konkan southward. This tree yields a dark-brown resin *Bhaga-dup*—which is obtained by tapping the trees, and used in dysentery and bronchitis.

QUASSIA AMARA ³—*the Quassia Tree*—is in our gardens a very pretty shrub, difficult to propagate, therefore rare and costly. In the Botanical Gardens at Calcutta it may be seen growing on a rich alluvial soil fully exposed to the sun. The leaves are alternate, unequally pinnate, having about seven long, narrow, entire pinnæ and crimson-tinged wings on the leaf-stalk. The flowers are in terminal clusters—bright scarlet, tubular, and about 1½ inches in length. Propagation is most safely effected by layering.

¹ *Ailantus*, from *ailanto*, referring to its lofty growth. *Glandulosa*, having small glands.

² *Excelsa*, tall.

³ *Quasia*, a name given by Linnæus to a tree of Surinam, in honour of a negro who employed its bark as a cure for fever. *Amara*, bitter.

OCHNACEÆ,¹ *The Wild-Pear Family.*

A small group of trees or shrubs with watery juice and alternate simple coriaceous stipulate leaves and showy flowers having five to ten deciduous petals. The only one found in gardens is—

OCHNA SQUARROSA²—*Kunuk-champa, Yerra-juvee.*—A pretty shrub, with oblong, ovate, finely serrate leaves falling in the cold season, and yellow, fragrant flowers, with deciduous petals, appearing from February to April, succeeded by fruit, consisting of three to ten distinct *drupes*, ripening in June. This shrub thrives without special care in Bombay gardens within reach of the sea-breeze, but appears to be delicate in a hot, dry climate. Propagate by seed.

BURSERACEÆ,³ *The Frankincense Family.*

A group of balsamic trees and shrubs of great interest as the source of bdellium and other odoriferous gums. A few are useful in the garden for fencing.

BOSWELLIA SERATTA⁴—*Salie, Lobán, Googoolupoo-chitoo.*—A small tree abundant on the hills of the hot, dry parts of India, the source of a sweet-smelling gum resin used as incense. Large cuttings of this tree grow well if inserted about the end of the rainy season, and watered occasionally till rooted.

GARUGA PINNATA⁵—*Kurak, Kurak ghogar, Kaikar.*—A tree with alternate, unequal leaves, which early take

¹ *Ochnaceæ*, from the genus *ochna*, the old Greek name of the wild pear.

² *Squarrosa*, ragged or deeply divided, referring to the calyx.

³ *Burseraceæ*, from the genus *Bursera*, after Joakim Burser, a disciple of Gaspar Bauhin.

⁴ *Boswellia*, after Dr. Boswell, formerly of Edinburgh. *Serrata*, toothed like a saw.

⁵ *Garuga*, from the Telingi name. *Pinnata*, having leaves divided horizontally like a feather.

on a yellow shade and fall during the cold season, and large bunches of smooth, fleshy fruits of a pale green colour, at a distance resembling bunches of white grapes. While in fruit it is highly ornamental, and is useful for rough, stony places. Propagated by seed or large cuttings.

COMMIPHORA MUKAL¹—*Googa*.—A small, thorny tree bearing trifoliate leaves, of which two leaflets are very small and one from 1 to 2 inches in length and oval in shape. The outer bark peels off in thin flakes, exposing the green under-layer. It is the source of the gum resin, bdellium, and is found on limestone rocks in Scind and some dry hill ranges in the Deccan. This plant may be propagated from large cuttings, and its thorny habit makes it a useful fence plant.

MELIACEÆ,² *The Neem Family*,

Has many beautiful and useful trees, of which mahogany, *toon*, and the *nim* are examples. As a rule, seeds in this family are short-lived, and must be sown while quite fresh.

SWIETENIA MAHOGANI³—*the Mahogany Tree*—is a native of Central America, but thrives at Calcutta, Madras, and Kirkee on a deep alluvial soil, watered while the tree is young. It has upright habit and dark-green, alternate, exstipulate, primate leaves, with entire oblique leaflets. Propagated by seed.

SWIETENIA MACROPHYLLA promises to become a grand tree on a deep alluvial soil.

MELIA AZEDARACH⁴—*Bukan, Bakayan*—with a fair garden soil and occasional watering, needs no special

¹ *Mukal*, the vernacular name.

² *Meliaceæ*, from the genus *melia*, the Greek name of the ash tree.

³ *Swietenia*, after Gerard von Swieten, a Dutch botanist, 1700—1772. *Mahogani*, from the vernacular name.

⁴ *Azadarach*, the Persian name.

attention. Its flowers are lilac-coloured and sweet-scented, and its leaves are thrice divided. The latter characteristic serves to distinguish it easily from *AZADIRACHTA INDICA*, *Margosa* or *Nim trees*, *Nimbay*, *Limbro*. A well-known tree, very useful on road-sides in districts with light rainfall. To plant this tree, prepare holes three feet deep, place any sweepings or manure available at the bottom, fill in the hole with surface soil, and sow a few seeds as soon as they are ripe in September, and water occasionally if the weather is dry. Protect with thorns during two or three years and the tree will give no further trouble.

MELIA COMPOSITA—*Kadu-khajur*, *Rohituka*, *Harimkhana*, *Bheria*, *Mududad*, *Marum*.

AMOORA ROHITUKA—*Rohituka*, *Harrin hara*, *Raktarohida*.

*CHLOROXYLON SWIETENIA*¹—*Behrabethru*, *Billu*, *Haldu*.—The Indian satin-wood tree.

AGLAIA ODORATISSIMA—*Priyangu*, *Tottila-kayi*.

SOYMIDA FEBRIFUGA—*Rohun*, *Rohina*, *Soymida*, *Wond-marum*.

CHUCKRASSIA TABULARIS—*Pabba*, *Dalmara*, *Chick-rassi*, and

CEDRELLA TOONA—*Deodari*, *Karuk tuda*, *Tunna*, *Mahanim*.

All the above are fine hardy trees growing in a variety of conditions, and thriving in deep, stony soil if fresh seeds are sown and slight shade and protection given until the tree is established.

ILICINEÆ

Is a temperate climate family, but a few occur on Indian hills.

ILEX INSIGNIS, from Darjeeling.

¹ *Chloroxylon*, greenwood.

CELASTRINEÆ, *The Spindle Tree Family.*

A group of small trees with sometimes spinescent branches and opposite or alternate leaves and small flowers. A few are planted as shrubbery and are valuable in medicine.

CELASTRUS PANICULATUS—*Malkangani, Valuluvaí, Atiparicham, Pigavi*—is a hardy shrub, plentiful in hilly districts, having lenticular warts on the branches; oval-oblong or ovate-serrate acuminate leaves; small yellowish-green flowers in terminal pendulous panicles producing a three-celled globose capsule containing three to six seeds with a complete *arillus*—a covering on the outside of the true seed-coat arising from the seed-stalk. The seeds “are considered to be useful in rheumatism, gout, paralysis, leprosy, and other disorders” (Dymock, *Veg. Mat. Med. of W. India*). Propagated by seed in ordinary soil.

ELÆODENDRON GLAUCUM¹—*Bud-kase, Tumruj, Nerija*—is a hardy shrub with elliptic or ovate-serrate shining leathery leaves, opposite and sometimes alternate. Its leaves, when dried and powdered, are used as a sternutatory, and its smoke to rouse women from hysterical syncope (Dymock, *Veg. Mat. Med. of W. India*). The name *Bud-kase* implies hair of an evil spirit. It is propagated by seed or layers.

CATHA EDULIS—*Kat*—the Arabian Tea, is a handsome shrub grown on the mountains of Yemen, Arabia, and thriving in gardens at Poona with slight irrigation and shade. It grows freely wherever coffee thrives. Propagate from cuttings. The young branches bearing leaves are chewed either fresh or dried, and are said to produce great hilarity of spirits, and are exported from Yemen to ports on the Arabian and African coasts.

¹ *Elæodendron*, from *elæo*, an olive; *dendron*, tree. The fruit resembles an olive.

RHAMNEÆ,¹ *The Bor or Jujube Tree Family.*

A tribe of erect, or scandent, trees or shrubs, with thorny branches and simple coriaceous leaves, usually alternate, with three to five prominent vertical ribs, and small greenish flowers, in dense axillary cymes, succeeded by drupaceous fruit.

*ZIZYPHUS*² *JUJUBA* — *Bhor-kool, Rengha, Bhaer.*— This thorny tree has not been cultivated as much as it deserves. Its fruit is considered by the people of India very delicious, and it is said that Mahomet included it among the joys of Paradise. That it has a peculiar perfume which requires early training to enjoy, is well known, but the fact does not detract from its practical value. Like other fruit trees generally raised from seed, there is great variety in size, shape, and flavour of the fruit. The best are elliptical, 2 inches in length by 1 in thickness, and are propagated by inarching, or budding, on seedlings of the common sort. This fruit may be grown to perfection in districts with scanty rainfall, and is benefited by pruning away all the small branches after the fruit is gathered in January or February. To raise this tree, sow seeds in any *deep*, friable, stony soil, and when two years of age, bud with the superior variety *as low as practicable*, performed exactly as in roses, and is successful during June to December. If plants are wanted to send away, seeds should be sown in pots, and, when of sufficient size, inarched to the good variety. The seedling takes two years to attain a fair size.

Varieties of Bor.—*Khareki*, elliptical, white, sweet.

Chini, globular, red, „

Randeri, „ „ „

¹ *Rhamnææ*, from the genus *rhamnus*, from *rhamnos*, the old Greek name.

² *Zizyphus*, from *zizouf*, the Arabic name of the fruit.

VITACEÆ, *The Grape Vine Family.*

Numerous species of wild vine (*Vitis*) grow on the hill-ranges of India, and form very elegant coverings for arbors and the fronts of houses. A few handsome species have their home on the sea-shore, rooting between the rocks, and, with stems spreading on the heated surface, appear able to bear a high temperature. Many of the species are highly acrid, and are used by the practical joker; yet *Vitis indica* and *Vitis edulis* are stated by Tennant, in Ceylon, "to yield a copious draught of pure, tasteless fluid." Roxburgh, in the *Flora Indica*, describes twenty-two species, and Dr. T. Cooke, in the *Flora of the Bombay Presidency*, has the same number.

VITIS VINIFERA¹—*The Grape Vine, Angur.*

"There is no tre that growe
On earth, that I do knowe,
More worthy praise, I trowe,
Than is the vine."—*Anonymous.*

From the changes that have taken place in the English language, it is evident these words were written several hundred years ago, yet they are as true to-day as when first written. The vine is still a valuable plant, of long life and bearing immense crops wherever the climate is suitable.

The grape vine grows freely in a warm, *dry* climate with a growing-season temperature of 65° to 70° and a resting-season average of 55° to 65°, the minimum being above freezing point of water, although a few degrees of frost can be kept off by covering the plants. The soil should be proved of good quality by bearing a variety of crops, by not cracking during dry weather, or becoming muddy during wet weather, and at least 18 inches deep. It should be manured with 45 tons per acre of town or stable sweepings, then ploughed deeply, and allowed to

¹ *Vitis*, the name used by Virgil, from *vico*, to bind, in allusion to its clinging character. *Vinifera*, wine-bearing.

lie under a crop of Lucerne or Alfalfa (*Medicago sativa*), Gram or Harbara (*Cicer arietinum*), or Sunn (*Crotolaria juncea*), or some other member of the Pea family, the seed of which may be cheap and available in the district. The crop should be ploughed into the soil, and after it has lain a short time to decay partially, be re-ploughed across the former line, so as to be in a thoroughly friable and rich condition. Meanwhile, the young plants are under preparation in good, ordinary, recently-ploughed soil, which is deepened by cutting out trenches, 3 feet in width and 6 inches in depth, at a distance of 6 feet apart, and throwing the soil on to the intervening space. There is thus prepared 6 feet of deep soil, thoroughly worked without manure. In this bed the cuttings, 6 to 8 inches in length, and having the lower buds removed, are planted about 1 foot apart, being inserted nearly their full length, with a dibble, to avoid breaking the delicate bark; then covered with straw or leaves to keep cool, and watered when dry. The first watering should be heavy, to settle the soil near the cuttings; the rest to be just sufficient to keep the soil moist. The cuttings will take root and run all over the surface, the canes being cut back just before transplanting. The time for putting in cuttings is a month after growth has finished for the season, October to November for the northern hemisphere, and the corresponding season elsewhere, and for transplanting, a month before the growing season sets in. The cuttings should be pruned to a few buds a month or more beforehand; if deferred till the transplanting time, "bleeding" may occur and great loss be met with from the effects of sap running to waste, which is frequently the case if pruning is deferred till the growth begins. Transplanting time may occur during hot dry weather; it is then desirable to cover the recently-moved plants with straw or leaves to keep them cool.

For field culture, 6 feet apart in the line, and 6 feet between the lines, is convenient; or less, if the conveyance of the crop and the ploughing after pruning can be effected with less space.

The vine bears flowers soon after it has burst into leaf, that is, about the time the rainy season sets in, and fruit from those early flowers does not ripen in hot climates. The half-grown fruit usually drops off, or are taken off to make jam. The flowers which bear fruit come about the end of the rainy season, grow during the cold season, and ripen as the hot weather approaches.

To prepare the ground for a Vine Plantation.—Having selected a plot that has been proved to be first-rate soil for general purposes, and drained so effectually that there may be no danger of water stagnating in the soil—at the same time, the level should be such that very little or no water will run off the surface, but as much as possible go slowly through the soil—

MANURE should be applied at the rate of

30 tons per acre of cow-dung,	
or 40 " " "	town sweepings,
and 4 " " "	bones roughly broken,
or 1 " " "	$\frac{1}{2}$ -inch bones,
and 4 cwts. " "	saltpetre,

and the soil thoroughly ploughed, or dug 18 inches deep, and laid out for irrigation.

The vines may be planted out in lines 8 feet apart, with the same distance between the plants in the line, and the intervening space planted with any crop that may be in local demand and needing irrigation—for instance, beet, knol-kohl, spinach, lettuce, and such crops which do not grow high—so as to keep the light from the young vines. If the vines have grown properly, by September supports will be needed. For this purpose, there are few plants better than Pangara (*Erythrina indica*), because large cuttings root freely and remain firm and safe from white ants. These supporting plants must be kept within bounds by frequent pruning. To raise the supports at the beginning of August, plant straight cuttings of pangara, 6 feet in length, to a depth of 1 foot, and 1 foot distant from the vine. By

September, the cuttings will be rooted, and the vines may be tied up to the pangara.

The vine plant at this stage should be one simple stem without branches. If it has been broken and branched out near the base, it will be advisable to cut back to a strong bud beneath the branches, and lead out a new shoot to form the main stem, which should be stopped about a foot above the end of the support. Several branches will appear there, and much skill can be applied in their regular disposition, so that all may not be on one side, but at regular intervals and surrounding the stem. This is to be attained by rubbing out superfluous buds. Those side shoots are important, because they are to bear the fruit, and its development is favoured by the regularity of the disposition of the branches, which permits of an equal flow of the sap to each. Six main branches may be retained at a distance apart on the stem as near to 4 inches as is practicable—this takes up 2 feet of the upper part of the stem—and if the branches are trained to radiate in different directions there is no overcrowding, and a balance is maintained. Each of these branches should bear three bunches of grapes, and should be supported by turning in the end after it has grown 4 feet and making it fast to the support. At the hot season pruning, after the fruit is gathered, it is intended to cut off the reversed portion, leaving the fruit-bearing branches 2 feet in length. Those branches will send out several shoots, which may be cut back to three strong eyes at the October pruning: from these eyes shoots will come that will bear flowers, and the end may be pinched off about four leaves beyond the flowers. While the vine is young only one bunch should be permitted on each shoot, but when well established two or three bunches may be taken.

If large, well-developed fruit is wanted, only one bunch to each branch should be allowed, and as soon as the grapes have attained the size of peas, the bunch should be dressed with a pair of vine dressers—long,

narrow scissors drawn to a point, but not sharp at the end. With this implement any weakly branches in the cluster, or defective and crowded berries should be removed. This tends to the better development of the remainder.

Some flowers will probably appear during the first year, and a small quantity of badly developed fruit might be ripened, but more profit will be ultimately obtained by picking off the flowers as soon as they are seen and allowing the energy of the plant to go to form a well-developed set of branches capable of bearing fruit in quantity during succeeding years.

Renewal of Bearing Wood.—The main branches will bear healthy fruit spurs about three years, and a look-out for fresh branches in suitable positions should always be maintained, so that worn-out ones may be cut out gradually and a full supply of bearing wood maintained.

PRUNING AND TRAINING THE VINE.

How varied are the methods employed may be found from the following notes:—

Champagne District.—Vines are pruned so as to leave two to three branches, each with two to four buds. Every three years the plant is laid down and covered with soil, leaving one year's growth above the surface. Soil worked by hand. Vines trimmed low.

On the Loire.—Arches of bearing canes from stake to stake, and four vines arched to one centre and tied.

Moselle.—No training whatever, the vines being allowed to run, like melon vines, on the ground.

Medoc.—When vines are three years old they are trained, V-shape, to stakes and posts that are connected together at the top, and repeatedly pruned. Not allowed to have more than two branches.

Haute Garonne.—Vines are trained to stakes and trees in the form of a goblet.

Germany.—Height rarely exceeds 4 feet, and are trained to stakes.

Italy.—Little training is given.

America.—Trained on wire strung between posts 8 to 10 feet apart, first wire 2 feet from the ground.

California.—Closer pruned the better; summer pruning after the bunches are set.

Pinching back fruit-bearing shoots two leaves above the the fruit has long been held as a fundamental article of faith, but exact experiment has proved the operation to be futile.

Ville's manure for vines is—

Calcic superphosphate, -	528	lbs.	per	acre.
Potassic nitrate, - - -	448	„	„	
Calcic sulphate, - - -	352	„	„	

1320 lbs. per acre.

THE HOT SEASON PRUNING OF THE VINE.

While the fruit is ripening, water should be gradually reduced, so that by the time the fruit is cut the leaves have mostly turned yellow, and a few days' more drought will cause the greater part to fall off. This is the chief pruning time. The fruit-bearing branches should be cut back to 2 feet in length. It is not from those branches directly, but from short branches to be developed on them, called spurs, that fruit is to be expected in coming seasons. Loose bark should be peeled off, because it harbours insects, and a thorough coating of the mixture of earth and cow-dung, which people use for their floors, should be given, to destroy the eggs of some insects already deposited and prevent the deposition of others.

The vines having been loosened in pruning, it is advisable to leave the branches hanging till the sap has

fairly started to run and leaves to develop, because in tropical climates the rush of sap upward is so great that if the vines are kept upright the higher buds only will start into growth, and the lower be left insufficiently nourished during the first few weeks; but the lower buds having started well, are able to maintain equality with the upper ones when the branches are tied up. At the same time the soil should be dug thoroughly, except the space of about 3 feet round each vine, where the main roots are abundant which are to furnish the young feeding roots during next season; this part should be gently forked over and any weeds cleared. The remainder of the ground should be full of fine roots, and the digging has a beneficial action by breaking those roots and sending the plant more completely to rest. When the pruning and digging are finished, a heavy dressing of manure should be given. Poudrette is the best at this stage; it is largely used at Nasic, where grapes are grown in large quantities.

The ground should then be re-arranged for irrigation, and left to wait the rainy season—that is, if the plants will remain so long without starting into growth, but oftener they anticipate the monsoon by bursting into leaf, and if water is withheld then injury is caused. Growth once started must be kept up steadily. When a few leaves have appeared on the new shoots, flowers will be seen, which would, if allowed to remain, produce small bunches of sour berries at the end of the rainy season and cause a deficiency during the hot season, when ripe fruit might be expected. The development of foliage should be fully encouraged at this time, because then the leaves are laying up the store of material to be afterwards formed into grapes; the branches being tied in gently to give support during strong winds. At the end of the rainy season a second flowering takes place, and the atmosphere being warm and dry when the fruit is ripening, it is developed as well as the nature of the climate will permit the particular sort cultivated to attain.

Delicacy of Varieties in respect to Climate.—It is well known that the great number of varieties of the vine are very delicate in respect to climate; and because a particular variety is fine in one place it is not a good reason for expecting it to succeed in another. The vines which produce the highest class of wine have often been taken from their special districts to others, in the hope of extending their culture, with little or no success so far. Whether this fact is due to the presence of a special bacterium, and is not a soil and climate effect, is so far doubtful, but highly probable.

Age of the Vine.—In temperate climates the vine attains a great age, and in exceptional circumstances also lives a long time in this country; but the irrigation that is necessary at length brings the soil into a condition in which it is unable to sustain luxuriant growth, although manure is given as before, and the vines become weakly after eight or nine years. So if a steady supply be required, it is advisable to make a fresh plantation yearly to take the place of one of the exhausted plots, which will recover by a change of crop.

System of growing the Vine at Hyderabad, Scind.—A clever adaptation of the system of pruning the vine chiefly used in Scotland was employed at Hyderabad, Scind, by Mr. Strachan, with great success. On a plot of ground thoroughly manured and worked, as described in former chapters, obsolete telegraph poles 12 feet in length are erected in lines 20 feet apart; the poles are 10 feet apart in the line, and being inserted 3 feet in the ground, are 9 feet in height. Longitudinal battens are fitted to the poles, and wires stretched transversely at a distance of 3 feet. Near each wire, on both sides of the vinery, a vine is planted and trained along the wire until the plants from both sides meet in the centre. Each stem or rod—as it is technically called—is then permitted to throw out side-roots, which are ultimately pruned so that the side shoots of one vine meet those of

another, and consequently are about 18 inches in length; those side branches are carefully tied up, and being encouraged about 9 inches apart on the stem, cover the vinery entirely with foliage, the fruit being suspended underneath as in the home vinery. The result is a grand development of fruit, easy protection by nets from many enemies, and good pecuniary returns.

Indian Varieties of Grape.—When compared with the large varieties of desert grapes, the sorts common in Indian markets are generally considered very poor; but if they are properly grown and allowed to ripen fully on the vine, there are few sorts finer. We do not get properly ripened fruit, because such does not bear carriage unless it is packed with extra care, and it does not keep in the condition the fruit-seller thinks is right for a long time on his stall, so he neglects the high price he might obtain by selling properly ripened fruit, for the certainty of a mediocre price by selling half-ripened fruit which may be brought to the market in baskets of 50 lbs. weight, while ripe fruit would need cotton packing and a separate compartment in a box for each bunch.

VARIETIES OF GRAPES CULTIVATED IN INDIA.

The favourite varieties of grape that are grown in Europe have been introduced many times in India, but, with few exceptions, fail to become established; and it will be found that little progress has been made in vine-culture in India since the days of Speede, who described the vines in general cultivation many years ago.

Why have we been at such a standstill? We have been trying to introduce good sorts from other countries, and by that means steal a march, forgetting the principle of selection for particular climates that underlies all progress in the cultivation of plants. Instead of introducing foreign varieties only, we should grow the varieties at hand to perfection, cross-breeding them by hand-fertilisation, sowing the seed produced, selecting the few

good varieties obtained by that process, and discarding all others. The pollen of foreign sorts may be applied to the stigma of the sorts that have been proved to thrive; and among the cross-bred plants obtained there is a probability that a few may be superior to the sorts already in cultivation in this country and at the same time suited to the climate. At present we have established in cultivation the following varieties of grapes:—

WHITE MASCADINE—*Safed Ungoor*—is the most commonly cultivated, producing abundantly, middling-sized bunches of small, round fruit of a greenish-white colour, and rich, sweet flavour.

WHITE PORTUGAL—*Cashmeree* or *White Tokay*, *Walayetee Ungoor*.—The bunches are large and loose: the berries long-shaped, hard-skinned, sweet, and but slightly acid. This grape keeps a long time after ripening, and is commonly packed in cotton in small circular wooden boxes that are sent to all parts of India.

GRAPE “CABRAL” of Hogg (= “Cabul,” no doubt).—Bunch medium size, not shouldered, well set; berries very large roundish oval; skin yellowish-white, tough, and membranous, covered with thin white bloom; berry-stalks very short, thick, and warted, having a very large warted receptacle. Flesh firm, very juicy, sweet, inclining to be rich when highly ripened, but generally with a watery juice, and poor, sweetish flavour.

BLACK MONUKKA—*Bae-danae Ungoor*.—“*Ne longe sorte*,” as it is called in one of the letters of Garrard, an early Governor of Bombay. A very fine variety, resembling the *Cashmeri*. The fruit is purplish-red in colour, small, long, egg-shaped; flesh firm, tender, seedless, very sweet; bunches very large, long, and tapering. Unfortunately this variety has of late years been specially attacked by fungoid disease in the Deccan and in the districts where it has been famous since the time of Gerrard, it is now scarce, but a fresh stock procured from the Royal Horticultural Society, London, is in cultivation.

SULTOMAH or SULTANICH GRAPE, from which the "Sultana" seedless raisins are prepared, appears to be very closely allied to *ye longe sorte*, the berries are described as oblong-conic 23 mil. long, rather less than one inch; 16 mil. wide, rather less than $\frac{3}{4}$ inch; greenish-amber in colour, flushed and speckled with pale purple, flavour pleasant, slightly sugary, combines subacidity with sweetness, this is probably the same as—

FAQUIRA.—Colour greenish-white, berries small, oblong, cylindrical—thirteen weigh 2 ounces. Leaves large, slightly divided, pale green, with white stalks.

THE BLACK HAMBURG, *Hubshee Ungoor*.—When well grown it is of a deep bluish-black with a fine bloom; large roundish ovate in shape, flesh firm, yet tender, juicy, with a pleasant rich flavour; bunches medium size, compact; but commonly the colour is a dark mahogany or deep brown.

ENEMIES OF VINE CULTURE.

The most serious enemy of vine culture in India hitherto has been one of the many forms of vine mildew, a parasitic plant called *bura* or *rog*, which covers the lower side of the leaves and the flower branches with white silky erect threads which bear very minute seeds¹ in innumerable quantity; the body² of the parasite consists of long white threads living widespread in the tissues of the sick plant or host, consequently external applications have little effect, except, if repeatedly applied, by reducing the quantity of seed produced by the parasite, and thereby assisting the vine to outlive its internal enemy. When a whole vine-growing district is affected, and numerous separate owners have to be considered, a cure becomes very difficult, but an isolated vineyard may have the vines cut down to 6 inches or so of the ground, the stump covered with not less than 4 inches of earth, and the pruning and supports burned on the spot. This is the only known remedy.

¹ *Seeds, spores.*

² *Mycelium.*

VITIS DISCOLOR—*Telitseyal*.—A very fine climber, native of hill ranges throughout India. The leaves are cordate, oblong, pointed, with bristly serratures; the upper surface is bright velvety green and spotted or mottled with white, the underside is deep-red purple; both surfaces as well as the angular branches are smooth. The flowers are small, yellow, produced profusely during the cold season. Conservatory treatment with abundant watering during the rainy season and little during the cold and early part of the hot season is suitable. The plant should be cut well down yearly, and be propagated by cuttings inserted in September.

VITIS AMAZONICA.—A pretty climber having oval, pointed, smooth leaves, red beneath, with silvery veins above; in treatment it resembles the above.

VITIS ALBO-NITENS has oval, oblong, pointed leaves, heart-shaped at the base, shining on the upper side and suffused with a brilliant silvery white tone of colour. In the Victoria Gardens, Bombay, this pretty climber may be seen clothing a shaded wall with its luxuriant foliage; it evidently enjoys a moist atmosphere and slight shade.

VITIS WOODROWII—*Girnul*—is an erect shrub 5 to 6 feet high, producing branches which die back yearly to within a few inches of their origin, and leaves 9 inches in length and breadth. It grows naturally near the eastern side of the Western Ghats, at about 2,000 feet altitude.

VITIS QUADRANGULARIS—*Chaudari*, *Harsankar*, *Kandvel*—is an interesting plant, used in curries while young. It grows easily from cuttings without special care.

LEEA MACROPHYLLA—*Dinda Samudruka*.—A tuberous rooted herbaceous plant found on the Western Ghats, and other hill ranges, producing a few simple leaves, the lower nearly 2 feet in length and almost as broad, the upper leaves smaller. It thrives under a

heavy rain during the monsoon season, and remains dry during the remainder of the year. Plants may be collected in the jungle during the hot season.

LEEAE SAMBUCINA — *Karkani, Dinda*—forms a very handsome shrub when planted out at the rear of a bank of foliage plants in the conservatory; its young foliage having bright crimson shades. It may be propagated by cuttings taken as low as practicable. Several other species and highly decorative varieties are in cultivation.

LEEAE AMABILIS has a distinct white midrib, and some varieties have also white veins: this variegation on the dark green leaf surface makes a very ornamental plant. It requires to be kept pot bound and in a moist atmosphere to retain the fine colouration.

SAPINDACEÆ,¹ *The Soap-nut Family,*

Are trees, shrubs, herbaceous climbers of extremely variable aspect, which will be understood from the following examples better than from a description.

The production of the soap-like principle in the seeds and the bark as a fish poison, is common in this family.

CARDIOSPERMUM HALICACABUM, Balloon Vine—*Jyotish-muti, Noaphuiki, Sibjhul, Nalla-gulisienda, Tejovati, Kapal-phodi*.—A climbing herb of the Deccan, bearing large inflated pods enclosing a few seeds which are black, with a heart-shaped white mark when ripe. A few seeds of it sown near the root of any small shrub of open, hardy character produces a pretty effect. Seed should be selected from plants having the largest capsules, as great variation in size occurs.

DODONÆA VISCOSA²—*Zakami, Sanatta, Bumbhi, Mendra Banderu*.—A stiff, wiry, virgate shrub with

¹ *Sapindaceæ*, from the genus *Sapindas*, from *Sapo indicus*, Indian soap.

² *Dodonæa*, from Dodonæus, physician to Maximilian 2nd. *Viscosa*, viscid.

alternate smooth entire leaves, widening from the stalk upwards, is one of the best plants for edging to wide roads; for internal division in a garden, or to hide objectionable objects it is very useful. It thrives in a deep sandy or stony soil. If the soil is deep, after the first season it does not require watering. Propagation is effected by seed procurable from the Public Garden at Lahore, Karachi, and other places with a dry climate.

NEPHELIUM LITCHI.¹—The *Litchi* is a small tree with spreading branches and compound alternate extipulate leaves, having from two to eight leaflets, $1\frac{1}{2}$ to 6 inches by $\frac{1}{2}$ to $1\frac{3}{4}$ inches, and very small white flowers, producing a globose fruit about 1 inch in diameter in seedling plants, but as large as a hen's egg in select varieties, with a rough thin brittle rind of a dull brown colour when ripe, and containing one or two seeds having a large fleshy whitish covering (*aril*), which is the edible part. This Chinese fruit-tree thrives near Calcutta and at Bangalore. At Bombay it fruits well, but is not much grown, probably because the soil it would occupy is profitably engaged in bearing mangoes. The fact that the tree thrives at Bombay and Calcutta indicates a love for moisture, and at Bangalore it appears indifferent to considerable altitude. No doubt the true reason is the need for an equable climate and the absence of hot winds. At Poona the only healthy trees are in a well sheltered position, and it is reported to be a very delicate tree in the North-West Provinces. Of Litchi plants raised from seed, the proportion which bears good fruit is so small, that it is practically of no value. Sorts worth cultivating are propagated by grafting, and layering by *guti*.

NEPHELIUM LONGANA—*Longan*, *Ashphul*.—A small tree of the Western Ghats and Eastern Bengal, is useful for the edible *aril* in gardens where the climate is moist.

¹ *Nephelium*, an ancient name for Burdock. *Lichi*, the Chinese name.

NEPHELIUM LAPPACEUM—*Rambutan, Rumtum*.—A highly ornamental tree in very moist districts, with a climate similar to that of its native Malaya. The bright red fruit is covered with soft spines and produced in clusters suspended from the ends of branches during June and July. It enjoys a deep soil and a hot moist climate, and is increased by seeds.

SAPINDUS LAURIFOLIUS—*S. marginatus*, the Soap-nut Tree—*Ritha, Rheta*—is a fine tree growing without special care in a moist climate, and a stony soil. It has alternate leaves with two to three pairs of sub-opposite entire leaflets, 3 to 7 by 1 to 4 inches. It is widely cultivated for its soapy nuts, which are produced in quantity in Algeria, and dispatched thence to Germany for the manufacture of soap. Propagate by seed.

FILICIUM DECIPIENS—*Singalese, Pehimbia gaha*.—A very ornamental tree, specially handsome while young, slow of growth, with large bright green fern-like leaves, having narrow leaflets and the midrib winged. Any good garden soil with a moderate water supply is suitable. Propagated by seeds, which are procurable during March and April from Poona seedsmen, and must be ordered in advance, and sown immediately on receipt.

MAGONIA GLABRATA—*The Tinggi*.—A large tree of Brazil yielding broad flat seeds, from which soap is made, and a root bark used to poison fish, would no doubt thrive in moist climates.

AKI TREE—*Cupania edulis*.—A fruit-tree of Western Tropical Africa bearing a pear-like fruit bright red when ripe, 3 inches long, enclosing seeds having a fleshy edible *aril*, agreeable when cooked with butter. It is adapted for a sandy soil and hot, moist climate. Plants are raised from seed and by layering.

ANACARDIACEÆ, *The Mango Family.*

This is a small group of trees represented by the Mango, Cashew Nut, Pistachio Nut, and Frankincense Trees. The terebinthine principle prevails so much in the group that it has been named *Terebinthaceae*. From a cultural point of view, the short life of the seed is the most characteristic feature. A deep alluvial soil, accessible to air and moisture through the presence of abundant stones, is desirable.

The FRANKINCENSE TREE—*Boswellia thurifera*, *Salia*, *Luban*—is an interesting tree, fit for planting over a wide area. Branches need only to be set in the ground during the rainy season to take root and grow without trouble about 2,000 feet altitude; at lower altitudes special care to secure drainage is necessary.

The PISTACIO NUT TREE—*Pistachia vera*,¹ *Gul-i-pisteh*, *Pistak*, *Getela*.—The tree which yields the well-known pistachio nut is stated by Aitchison to grow in forests at 2,000 feet altitude in the Bhadghis and Khorasan, and to be cultivated in Persia. In the north of India specimens of the tree may be seen in gardens, but southward it is difficult to keep alive. Its leaves are alternate, coriaceous, trifoliate, the outer leaflet larger than the other two. That its cultivation would be practicable in dry regions of the Himalaya there is little doubt.

SCHINUS MOLLE.²—A South American tree common in the basin of the Mediterranean Sea, and called the "pepper" tree, because the fruit is nearly the size and has pungency like pepper. It has pinnate leaves and long gracefully drooping branches. During the growing season, while its leaves are turgid with sap, an amusing

¹ *Pistachia*, from Persian *Pistas*. *Vera*, true.

² *Schinus*, from *Schinos*, the name used by Theophrastus for the mastic tree. *Molle*, the Peruvian name.

experiment may be made with its leaflets: if a leaflet, freshly cut, is dropped on the surface of water, the sap, rushing out in jerks, propels the leaflet like a little boat. This tree is easily raised from fresh seed, and is of rapid growth while young.

ANACARDIUM OCCIDENTALE.¹—*The Cashew-nut Tree, Caju.*—The “fruit” of this tree is the thickened fleshy stalk of the true fruit, which is the cashew-nut. As a fruit the stalk is not greatly valued, as the flavour is not delicate. The tree thrives in a moist climate, and, if fresh seeds are dropped, springs up in garden fences in the Konkan.

SPONDIAS DULCIS²—*Valayati amra.*—A small tree of the South Sea Islands, with graceful foliage of alternate odd-pinnate leaves with crenate leaflets, and bearing in March small yellow flowers, succeeded in September by oval fruit of an acid flavour and having a stone with projecting spines. The skin of the fruit has the russet colour of a fine pear.

SCLEROCARYA CAFFRA³—A South African tree having spikes of small flowers. Is found to thrive at Poona and Madras with ordinary garden treatment.

Rhus mysorens, *Amoni*; *Bachanania latifolia*, *Char*; *Odina wodier*, *Moya*; *Holigarna arnottianna*, *Hulgeri*; *Northopegia colebrookiana*, *Amberi*; *Garuga pinnata*, *Garuga*, *Jum*—all found on Indian mountain ranges—are interesting garden occupants when space can be spared.

CANARIUM COMMUNE—Java almond—*Rata-kekuna*. A large Malayan tree adapted for moist southern districts at low altitudes, and recommended by Mr. Mac-

¹ *Anacardium*—*ana*, above; *karaia*, the heart. The nut appears on the top of a swollen juicy peduncle commonly called the fruit. *Occidentale*, from the West.

² *Spondias*, the old Greek name used by Theophrastus for the plum, which this fruit somewhat resembles. *Dulcis*, sweet.

³ *Sclerocarpus*, from the hard fruit. *Caffra*, from South Africa.

Millan for avenues in Ceylon. The plum-like fruit has a "stone" enclosing a kernel similar in flavour to sweet almonds. Roxburgh found it did not thrive during the cold winter at Calcutta. It is grown from seed procurable at Paradeniya Botanical Gardens.

THE MANGO—*Mangifera Indica*,¹ *Amb*, *Mama-dichitoo*, *Mangus*, *Marum*.—By far the greater number of mango trees in this country are seedlings, and, as usual in such conditions, the quality of the fruit is extremely varied, some being among the most delicious fruit in the world, while the great majority have the turpentine flavour and fibre developed to a very undesirable extent.

The mango thrives on a deep and well-drained loamy soil, such as occurs on the banks of rivers; and dense soil, like the black soil of the Deccan, which cracks deeply during dry weather, is objectionable. A mean temperature of 75° to 80° F. is desirable, but a lower mean is sufficient, provided the thermometer rarely shows below 40° F.; and a rainfall of 50 to 100 inches, or irrigation equal to that quantity, is sufficient. Much less may be effectual where underground water is available, as on the banks of a river or tank.

The mango has only one embryo in the seed, but the seedling often produces buds at the base which may have given rise to the opposite idea.

Mango trees raised from seed of the best varieties give a percentage equal to the fruit of the parent tree so low as to be of no practical value unless special precautions have been taken to prevent cross-fertilisation, as explained in the chapter on "Plant Breeding," and no special nutriment, such as honey or milk, applied to the seed will affect the quality of the fruit of the future tree either for good or evil. Superior sorts are propagated by grafting, and to obtain a vigorous, healthy tree it is desirable that the stock upon which the good variety is

¹ *Mangifera*, mango-bearing. *Indica*, from India.

grafted has not long had its roots confined in a small pot. Should no other but cramped plants be available, they may be set as follows:—Prepare holes 20 feet apart and 3 feet each in dimension, the upper layer of soil being placed on one side, the lower part kept separate. At the bottom a quantity of bones and other manure may be placed; this may be covered with surface soil mixed with manure; and the remainder of the soil, mixed with manure, may be used to fill the hole to the surface. Near the centre a handful of fresh mango seeds may be planted, and the surrounding ground tilled for other crops. The seeds, having no interruption, will send a strong root to the bottom of the hole, and the plants may be pulled out gradually till only one or two are left. Then the plant bought from a nurseryman, with its roots twisted and starved, may be set in a larger pot, with good soil, and, after plunging to its rim in the surrounding earth, enarched to the vigorous young tree that was raised from seed on the spot it was intended to fill. Having formed a union with one, the purchased graft may be transferred to another. If it be more convenient to plant the tree as received, the insertion of three stakes about 6 inches from the graft, and brought together and tied at the top, to which the tree may be secured and shaded until well rooted, is desirable.

The young trees should be manured freely and watered with the other crops, and after five years of growth will have attained size sufficient to bear fruit in quantity worth the necessary protection from parrots. At this stage other crops between the trees should be discontinued, except *sun*n or indigo, which may be grown to dig in as manure, and irrigation should be suspended during the cold season, so that the trees may thoroughly ripen the flower buds. There is seldom occasion for water until the flowers have opened and been fertilised, as shown by the blossom withering and the young fruit appearing; after this the water may be turned on at intervals of ten to twenty days.

Sometimes, during the season of mango blossom, heavy clouds appear, and by intercepting radiation of heat from the earth, increase the temperature so as to cause evident distress to plants, shown by excessive wilting, although the usual cause of this sign of distress—a want of water at the root—be absent. Under such a cloud covering, the mango tree casts its flowers without fertilisation, and the prospective crop is not developed. The opportunity of observing this effect, and of taking measures to counteract it does not occur frequently—several years may elapse without its appearance, and only twice during long experience has the writer been able to try to counteract the effects of the great heat by flooding the ground with water. In both instances it was apparently effectual, but a much larger number of experiments is necessary before reliable data can be obtained. The water should be applied as early as the gathering clouds are observed, and the difficulty in getting hard work done promptly, which one's assistants regard as unwarranted interference with the work of higher powers, must be provided against. In the years in which this heavy cloud (*bhadal*) comes inopportunately, the fruit is scarce and brings a high price, and if the crop be saved the reward is considerable.

GRAFTING THE MANGO.

The subject is more fully dealt with under the heading GRAFTING. Here only may be noted the *tools* in use during the operation. The system used here is named CROWN GRAFTING. In the figure, No. 1 is a lump of kneaded clay now placed on the inverted bottom of a box. The clay is intended to cover all fresh wounds and keep out moisture, often containing fungus spores, which would cause fresh mischief. Leaning on the clay are the grafting knife and the pruning shears, besides a piece of bone sharpened gradually at one end—in fact, a tooth-brush, from which the bristles have been removed. The shape of tooth-brush handles varies considerably, and on

looking through the stock in a chemist's shop one may be found as if intended for the work of passing between the bark and the wood, thereby raising the bark which has been from about six inches from the superior end of the STOCK. No. 2 shows a common saw, which has been



GRAFTING THE MANGO.

used to cut off the head of the STOCK. No. 3 is an inverted pot with the bottom removed, to be used as a graft protector to keep the atmosphere round the graft moist. It will be necessary to cover the protector with green branches to keep off direct sun-rays. No 4 is the STOCK itself. No. 5 is a pane of glass, by which light is admitted, and the progress of the graft may be observed.

ENEMIES OF THE MANGO.

This grand tree struggles throughout life against numerous depredators: when only a few weeks old the pith at the base of the stem has a special attraction for rats, and many young trees are destroyed for a few bites, and it may be necessary to enclose the seedlings with wire-netting or lay down mixed with arsenic. Fortunately the season during which the young trees attract rodents is a short one. Leaf-eating caterpillars may be trapped by spreading a mat freshly coated with tar on the ground and shaking the branches, but a more serious enemy is the caterpillar that infests the pith of young branches; there is nothing for it but to cut off the branch and throw it into a pond where fish may benefit. The large grubs that bore a passage into the wood of mature branches may be caused to emerge by squirting in kerosene. The grub may be thrown to the crows, and the aperture closed with a cork or with clay.

When aphids have been sucking the juice of the tree and have covered the leaves with their viscid exudation, known as *honey-dew*, a black fungus thrives on the excretion, and gives the trees a very disagreeable appearance, but as it occupies only the upper surface of the leaf, and is living on the honey-dew, the fungus is not doing serious injury, and a few days of heavy rain will wash it off. Surface fungi of this kind may be killed by spraying with 3 per cent. solution of sulphate of iron, *hiracas*, but the dead fungus must be washed off, if the appearance of the trees is of importance.

Aphids and Scale may be combated with the means indicated under those headings.

SELECT SORTS OF MANGO.

Alphonse or Afus.	Kagdi Afus.
Archâi or Kala Afus.	Khoont.
Batâsi.	Langra or Malda Massarata.
Cowasji Patel.	Mulgoba.
Dulcé.	Nawsherwani.
Fusli-Bewa.	Pakria.
Fernandez or Firmadin.	Pyrie.

MORINGEÆ.

This order has only a solitary plant in Indian gardens—the well known horse radish tree.

MORINGA PTERYGOSPERMA—*Shevga, Sujna, Morunga*.—A small tree with alternate twice or thrice pinnate leaves, 1 to 2 feet in length; the ultimate divisions $\frac{1}{2}$ to $\frac{3}{4}$ inch, opposite, membranous and pale beneath; the petiole is slender and sheathing at the base. Small yellowish white irregular flower in spreading panicles, and long pendulous 9-ribbed fruit containing triangular seeds having wings on the angles.

The young unripe pods resemble asparagus in flavour, and are a valued ingredient in curries. The root has the pungency of horse radish, and is used in cookery for similar purposes. The delicate graceful foliage and the numerous white flowers combine to make a handsome garden tree if the branches are preserved during the gathering of the pods. It thrives in any fair soil heavily watered during a part of the year either by rainfall or irrigation, and may be grown from seed or cuttings. A wild form having large leaflets, described as *Moringa Concanensis*, occurs in Guzerat.

CONNARACEÆ.¹

A small tribe of erect or climbing trees or shrubs represented in our gardens by—

CONNARUS MONOCARPUS—*Sundar*.—A shrub on the Western Ghats from Vingorla southwards, having leaves of five elliptic, lanceolate, obtusely acuminate leaflets 3 to 4 by $1\frac{1}{4}$ to $1\frac{3}{4}$ inches. Flowers small, appearing at the end of the rainy season, succeeded by firm turgid bright red pods, enclosing one to two arillate seeds. During the cold season, when this shrub is in fruit, there are few more showy plants on the Western Ghats. Propagate from seeds.

¹ *Connaraceæ*, from the genus *connarus*, from *konnarus*, the name of an unknown tree described by Athenæus.

LEGUMINOSÆ,¹ *The Pea Family.*

This is a very large and important natural order, including many plants valued for pulse, fodder, timber, medicine, gums, dyes, and many are cultivated for the beauty or fragrance of their flowers. Generally speaking, the order is easily distinguished by its pods, which resemble the pea or bean pod.

In such a large family it is difficult to point out any special characteristic, a knowledge of which is of value to the cultivator, but the following may be useful. Many of the members of this family are deep-rooting, and therefore suited to a climate having distinct alternations of wet and dry seasons. The plants take up lime in considerable quantity, therefore its presence in the soil is necessary, and the seed keeps good—except in *Amhertia*, *Brownea*, *Saraca*, and others of the same group—for several years. Many of the species have nodules on the roots containing bacteria, and those microbes appear to have a share in fixing the free nitrogen of the atmosphere by causing it to combine with other elements, and become available for the use of plants; therefore plants of this family should be used to occupy all ground that is prepared for another crop, and has to wait the proper season, during which time it might become covered with weeds.

Potash is the dominant ingredient in manures for Leguminosæ, therefore wood ashes are useful manure.

The species are arranged alphabetically.

ACACIA ARABICA ²—*Babul*, *Telia babul*, *Godi babul*.—Is not exactly a garden tree, but for the outskirts of the garden in a dry climate, it is useful as a screen. At the beginning of the rainy season, the seed may be mixed

¹ *Leguminosæ*, from *legumen*, any kind of pulse.

² *Acacia arabica cupressiformis*, *Ramkanta*, has the branches growing upright close to the trunk.

with wet cow-dung, and left in sunshine a few days until softened, then sown thickly where the tree is wanted, and thinned out as necessary. The variety "vediana," *Eri Babul*, is short-lived, has softer timber and differs in many characters.

ABRUS PRECATORIUS—*Gunj. Ratti*.—A climber common in garden fences and bearing small pods which open and display bright scarlet seeds with a black spot, or other colours. The seeds are poisonous, and the statement that the roots are used as Liquorice is traversed by the *Phar. Ind.* The leaves being sensitive to weather changes, draw together when a storm is at hand, but that they foretell weather is disproved.

ACACIA EBURNEA¹—*Marmat.*—A small tree indigenous in the Deccan, has the foliage of the *babul* and a very sweet perfume; it is valuable in the outskirts of the garden where there is no irrigation.

ACACIA FARNESIANA²—*Vilâyati kâikar, Vilâyâti babul*.—An American species which thrives especially on moist soil, and has a delightful perfume. It is cultivated in the south of France as a source of perfume, and the value of the flowers is stated at £30 to £40 per acre. Why this industry is neglected in India is a serious question.

ACACIA MELANOXYLON.—The Wattel is now superabundant on the Vilgiri Mountains.

ACACIA PLANIFRONS—*The Umbrella Babul*.—Is a curious species extending its branches so as to form an almost level head. It is raised from seed, and thrives in dry climates.

¹ *Acacia*, from *akadzo*, to sharpen, in allusion to the spines many of the species bear. *Eburnea*, like ivory, alluding to the thorns.

² *Farnesiana*, probably in honour of the illustrious Italian family Farnese.

ADENANTHERA PAVONINA¹—*Koochonduna Runjina*.—A large tree with ample bi-pinnate leaves having 8 to 12 pinnæ leaflets 1 inch and minute flowers producing pods 6 to 9 by $\frac{1}{2}$ inch, early opening and displaying seed, which are generally of a bright scarlet and rarely yellow brown.

ÆSCHYNOMENE ASPERA—*The Sola Plant*.—A water plant producing thick pithy branches which float, and erect stems bearing pinnate leaves and pendulous racemes of yellow pea-shaped flowers succeeded by small pods which break into prickly one-seeded joints. The pith of the thick branches is the *Sola* from which sun-hats are made. It is propagated by seed or cuttings and grows naturally in shallow ponds with mud in Dharwar districts.

AMHERSTIA NOBILIS.²—This very beautiful and rare tree is a native of the banks of the Irrawady, and in India generally is found to be delicate, either hot dry winds or much cold proving fatal to it; but, like many other trees, its delicacy is much more marked while young than when established, and now, when conservatories are so common throughout India, there is some prospect of its more extended cultivation than has previously been possible. In southern districts the *Amherstia* might be planted on a bed of rich soil in a temporary conservatory, which would last until the tree was established a few years, then being gradually removed would leave the tree exposed. In the Botanical Gardens at Calcutta fine specimens occur.

Layering during the hot season, planting out in rich soil during the rainy season, and watering during hot weather, are the chief points in its culture.

The tree has large leaves of six to seven pairs of lanceolate pointed leaflets 7 inches in length; while young, pendulous, closely overlapping, and of a rich ruby tint.

¹ *Adenanthera*, alluding to the stamens bearing glands. *Pavonina*, peacock-like.

² *Amherstia*, commemorative of Countess Amherst, a promoter of botany. *Nobils*, noble.

The flowers are pendulous candelabrum-like clusters of red and yellow flowers drooping from all parts of the tree among the handsome foliage. Its seed loses germinative power in a very short time.

ALBIZZIA¹ MOLLUCANA.—A tree introduced by the Agri-Horticultural Society of Madras, in 1888; proves of rapid growth, at Poona, on a deep soil occasionally irrigated.

ALBIZZIA RICHARDIANA.—In Calcutta Botanical Garden, proves to be a grand ornamental tree.

ALBIZZIA LEBBEK, *Siris*, *Sirisha*, *Sirij*, *Sirla*, ODORATISSIMA,² *Sorissia*, *Bersa chichwa*, *Kali*, *Harrerri*, and PROCERA,³ *Kinye*, *gurbari*, *Kurra*, *Baro*, are often raised in gardens for roadside purposes, for which they are well suited, as it is easy to transplant any of them when of considerable size. *Kinye* enjoys a more moist climate than the other species, but there is no special difficulty with any of them.

ARACHIS HYPOGÆA⁴—The Earth-nut—*Bui mug*, *Mung fali* (from Brazil).—Is a common field crop in the Deccan and other countries having a hot dry climate without frost. The seed is sown in furrows 9 inches by 2 feet, when the heavy rain is over, that is, about September. The fruit buries itself in the ground and ripens in that position during the cold season.

Church's analysis has oil, 50; albumenoids, 24·5; starch, 11·7; water, 7·5; fibre, 4·5; ash, 1·8 per cent.

BEANS.

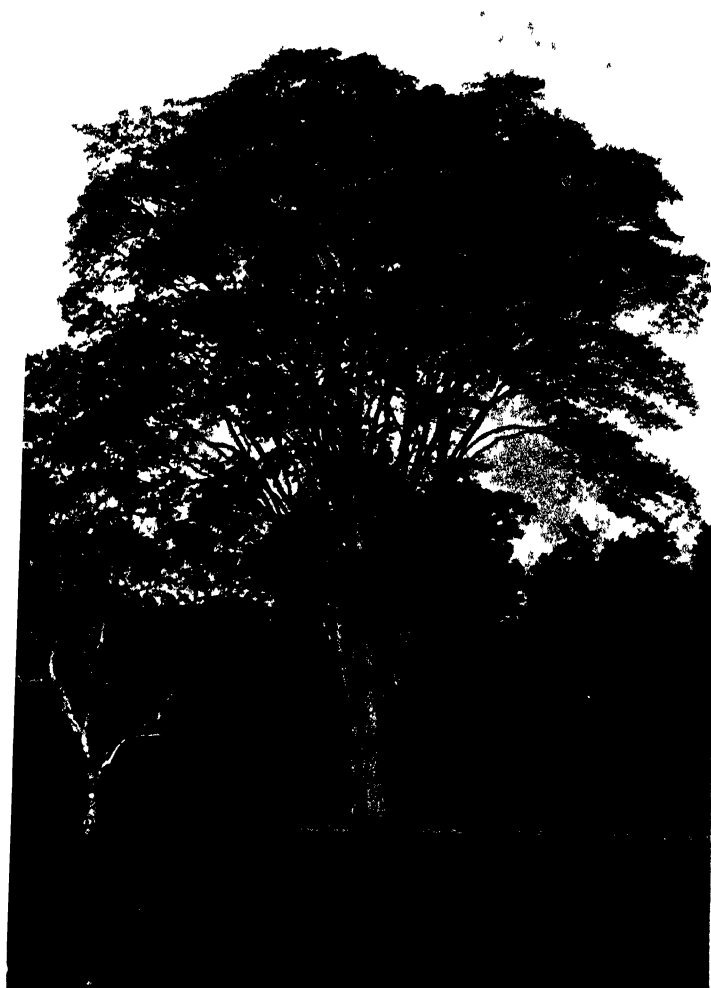
Kidney or French Bean—*Phaseolus vulgaris*. *Vern. Loba*.—Is easy to cultivate and gives good crops over the greater part of the country, excepting districts with heavy rainfall during the rainy season or much cold during the

¹ *Albizzia*, named after an Italian.

² *Odoratissima*, very odorous.

³ *Procera*, tall.

⁴ *Arachia*, from some Legume bearing plant; *hypogaea*, underground



ALBIZZIA RICHARDIANA

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DWARF FRENCH BEAN (SUTTON'S TRIUMPH).

(By favour of Messrs Sutton)

winter months. Any fair garden soil, well worked and enriched with manure, is suitable. Sow any time between the beginning of the rainy and the end of the cold season for black-seeded varieties. White-seeded kinds are more delicate, but yield good crops if sown between the middle of the rainy and the middle of the cold season. Put the seed in 2 inches deep and 3 inches apart in pairs of lines 1 foot apart. The distance between the double lines should be 6 feet for tall and 2 feet for dwarf sorts. Sow fortnightly in succession, and provide stakes for tall varieties to climb on; water freely once in four days during dry weather. Four lbs. of seed are sufficient for a family supply. Varieties may be found in seedsmen's catalogues.

Scarlet Runner Bean—*Phaseolus multiflorus*.—This seed is often included in collections sent from Europe. It grows and flowers well, but does not fruit satisfactorily in the plains; on the Himalaya it becomes a perennial with tuberous roots.

Broad Windsor Bean.—This popular vegetable can be grown at hill stations with the same treatment as dwarf kidney beans, but does not fruit well on the plains.

The *Chevaux de frise Bean*, or *Char-dari*—*Psophocarpus tetragonolobus*—and the *Lima* or *Double Bean*—*Phaseolus lunatus*—are very useful for giving a supply during the hot season when other vegetables are scarce. A deep well-manured soil is necessary, and a slight shade formed by erecting posts at short intervals with connecting bars at the top, over which should be laid a thin covering of grass, with free watering will cause luxuriant growth during the hot season.

BAUHINIA¹ VAHLII—*Chambul*—is a strong growing woody climber, having large bi-lobed nearly orbicular leaves densely hairy beneath and used as plates at feasts.

¹ *Bauhinia*, in honour of John and Caspar Bauhin, botanists of the sixteenth century.

In some positions this climber is highly ornamental; but if the soil be deep and rich, the climber is apt to destroy trees on which it runs. It may be raised from seed.

BAUHINIA MONANDRA—*Kachnar*—is a small tree with bi-lobed leaves and very abundant flowers resembling *Kunchan*, but with white, yellow, and crimson streaks. It thrives in the Deccan with ordinary garden treatment.

BAUHINIA VARIEGATA¹—*Kunchin*, *Kuchnar*. *Garal*, *Kuvidara*—is a small tree giving very beautiful flowers, 3 to 4 inches in diameter, of several shades of rose-colour, and adapted for a deep soil with occasional watering during dry weather. The flowers appear during the cold season, and, while buds, are used as a vegetable in Northern India. A pure white variety (*B. candida*²) and a deep crimson variety are in cultivation; the crimson sort should be grafted on the common one. Propagated by seed or layers.

BAUHINIA TOMENTOSA.³—An upright-growing shrub with ash-coloured smooth bark, bi-lobed leaves, and yellow flowers 3 to 4 inches in diameter, in axillary pairs and flat tomentose pods 4 to 5 inches in length and $\frac{1}{2}$ an inch in breadth. Propagated by seed. This charming shrub is much scarcer in gardens than it should be.

BROWNEA GRANDICEPS⁴—*The Rosa del Monte of Caracas*—is a close relation of the *Amherstia*, and nearly equal in elegance, while being more hardy; its culture is comparatively easy. In the Botanical Gardens at Calcutta fine specimens forming small trees, with pinnate leaves of about 12 pairs of pinnæ, about 6 by 1 inch lanceolate long-pointed, while young pendulous and overlapping as in the *Amherstia*, but brightly marked by

¹ *Variegata*, having different colours.

² *Candida*, white.

³ *Tomentosa*, having short soft hairs.

⁴ *Brownea*, after Patrick Browne, M.D., author of a History of Jamaica; *grandiceps*, large-headed.

shades of brown on a paler ground, or during the hot season by a great spike of glowing crimson flowers. This tree is a native of Caracas, and thrives in a moist equable climate, such as Calcutta and Madras, in a rich soil, with irrigation during the hot season. It ripens seed freely in the Botanical Gardens at Calcutta, and is propagated by layering.

BUTEA FRONDOSA¹—*Palas, Palasa, Maduga*.—This well-known tree requires little, if any, special care. It is propagated by seed, and in fair circumstances attains flowering size in about ten years. It is an important source of *lac*, an exudition of its sap caused by the attacks of a species of coccus.

CAESALPINIA CORORARIA—*Libi-Dibi*.—A valuable tanning material; forms a small crooked tree, and grows freely as a road-side tree in moist sunken districts. Propagated by seed. Introduced by Dr. Wallich, from South America.

CAESALPINIA GILLESII—A Chilian shrub having very elegant sulphur-coloured flowers with long red stamens. It grows nicely with ordinary treatment in moist districts.

CAESALPINIA PULCHERRIMA (Spanish Carnation)—*Sankesur (The Flower Fence)*.—A very pretty shrub, having twice pinnate leaves and abundant racemes of flowers, yellow and red in colour, and 1 inch in expansion: it grows with ordinary treatment.

CALLIANDRA HAEMATOCEPHALA.²—A tropical American, highly ornamental rare shrub, with twice pinnate leaves and dense heads of flowers, which have bright crimson stamens. It thrives in moist districts with ordinary garden treatment, and in dry districts with protection from hot wind and slight shade.

¹ *Butea*, commemorative of John, Earl of Bute, a munificent patron of botany; *frondosa*, leafy.

² *Calliandra*, beautiful stamens; *haematocephala*, blood-coloured head.

CANAVALIA ENSIFORMIS—*Abai (The Butter Bean), Makan-sim*.—The pods of this beautiful climber make an agreeable dish when cooked as kidney beans. The treatment should be the same as that crop, but the seed should be at least 1 foot apart and the stakes 6 feet high. The cheapest plan is to sow near a fence on which the plant may climb. The seeds are very large, some of bright red and others of a white colour.

CANAVALIA STOCKSII is a large flowering bean, native of the hills near Mahableswar, at an altitude of 4,000 feet, with a very heavy rainfall from June to September.

CASSIA¹ **ALATA**—*Mitta-tamara, Dád-mardan*.—A short-lived shrub, having large pinnate leaves and erect racemes of yellow flowers. The leaves, beaten to a pulp, are used against ring-worm and other diseases. It is propagated by seeds and cuttings, and thrives at Calcutta and Mysore.

CAJANUS INDICUS—*Tur-Dall*.—Although a field crop, should be in gardens to obtain improved varieties.

CAMEONIA² **MAXIMA** (from West Africa).—A woody climber, with trifoliate leaves and pure white petals, edged with golden in racemes. Thrives at Trinidad, Ceylon, and other hot, moist climates. Propagated by seed.

CASSIA FISTULA—*Bawa, Amaltas, Soondali, Suvarna, Jaggarwah, Warga, Gurmala*.—This very beautiful and useful tree has names in almost all the vernaculars of India, and is called the Indian *Laburnum* by Europeans. It is conspicuous by its bright golden flowers in long pendulous racemes and long cylindrical pendulous fruit, black when ripe, and containing a useful laxative medicinal pulp between the seeds.

¹ *Cassia*, from the Greek *kasia*, of Dioscorides.

² *Cameonsia*, commemorating Louis Cameons, author of the *Lusiade*.

The *Amaltas* is not as common as it might be, as it thrives in a great variety of conditions of soil and climate. No doubt its shy germination, delicacy while young, and difficulty in transplanting are the causes of its scarcity. To grow it, prepare deep holes filled with loose soil and sow, at the beginning of the rainy season seed that has been prepared for germination, by keeping in an earthen pot buried in a moist dung pit until swelling sets in.

CASSIA GRANDIS.—A rare and elegant tree, from the islands of the Carribbean Sea, and thriving in Deccan gardens. Its pinnate leaves are 8 inches in length, alternate, with scarcely apparent stipules, and 10 to 15 pairs of oblong leaflets $\frac{3}{4}$ inch by $\frac{1}{2}$ inch, having a short, sharp point, and gradually increasing upwards to the penultimate, which measures $1\frac{1}{2}$ inches by $\frac{1}{2}$ inch: midrib eglandular. The young branches and leaves are covered with short, dense, soft hair of copper colour; veins on the lower side, often bright red. The flowers are in abundant racemes shorter than the leaves. The flower stalk and calyx covered with short, soft, silvery hair, and the corolla bright pink about 1 inch in expansion, and, from their great abundance, very showy. The pod is about 1 foot in length, 1 inch in thickness, rough, woody, and with two prominent ridges on one side.

CASSIA REMIGERA (from Burmah), has been introduced to Bombay by Mr. Millard. It forms a small tree, 20 feet in height, bearing light pink blossoms with yellow stamens $\frac{3}{4}$ inch in diameter, and flowers two months.

CASSIA SIAMEA¹—*Cassia sumatrana*, Roxb., *Cassid*—is often raised as a road-side tree, but has little to recommend it beyond rapidity of growth and hardiness. It is easy of propagation by seed.

CASSIA MARGINATA²—*Urinedi Uskiamen*, *Ratoo-waa*.—A tree with dull light brown bark and a spreading

¹ *Siamea*, from Siam.

² *Marginata*, referring to the coloured margin of the leaves.

head of branches bearing alternate-pinnate bifarious leaves of 10 to 20 pairs of linear oblong leaflets 1 inch in length and half as broad, having the margins coloured and often thickened, and bearing during the rainy season axillary, solitary, racemes of flowers $\frac{1}{2}$ inch in width, in colour pink, marked with greenish veins. The fruit is 8 to 12 inches long, as thick as a man's little finger, of a dark brown colour, and having transverse partitions. This is a rare tree. Propagation is effected by seed.

CASTANOSPERMUM AUSTRALE.¹—An Australian tree found in many gardens in warm countries. It is of very upright habit, with pinnate leaves of about nine entire leaflets, and bearing, rarely, saffron-coloured flowers; during the hot season, producing a pod enclosing large seeds resembling chestnuts. Propagated by seed.

CERATONIA SILIQUA²—*St. John's Bread, Meccanee Amli*.—This small tree from Syria and adjacent countries, which bears the fruit known as St. John's Bread—and the fruit has been identified as the "husks which the swine did eat" (Luke xv.), and the seed as the original caret of Goldsmith—was introduced many years ago, and is found to thrive well in gardens in dry districts if irrigated until fully established. Its flowers are without petals, and *polygamous*, that is, some flowers have male organs only, others have female organs only, and a third section have both organs. In this tree, the different forms of flowers are found on separate trees, and when raised from seed a large proportion prove to be male. The fruit-bearing form is propagated by grafting. The value of the fruit hitherto has not been equal to that of a mango tree, which would occupy the same soil. In Southern Europe, exposure to a sea breeze is found desirable.

COLVILLEA RACEMOSA is a handsome tree, having a straight stem and large twice pinnate leaves with small

¹ *Castanospermum*, chestnut-seeded; *australe*, from Australia.

² *Ceratonia*, from *keration*, a bow, in allusion to the shape of the pods; *siliqua*, having pods.

leaflets resembling those of the *Gul-Mohr*. It grows nicely in a deep loamy soil at Poona and at Calcutta, and produces racemes of bright orange flowers.

*CROTALARIA JUNCEA*¹—*Sunn, Tag.*—The bark of this annual is the source of the valuable fibre called *sun*n; in the garden the crop is often sown for green manure. Any ground that it is intended to plant about the end of August may be sown thickly with this seed during May, and the crop dug in when the ground is wanted; this enriches the soil, and keeps down weeds.

CROTALARIA MADURENSIS (from Nilgiri); *C. RETUSA*, *Dingala* (of Mahableshwar); *C. VERRUCOSA* (which is almost cosmopolitan in tropics), are described in Cook's Flora of Bombay Presidency. Are ornamental, and may be grown in gardens without trouble.

CYNOMETRA CAULIFLORA—*Nam-nam.*—A small tree adapted for hot, moist districts with frequent rain; it bears on the stem and branches a one-seeded, wrinkled pod, which is considered edible and refreshing.

*CLIANTHUS DAMPIERI*²—*The Australian Glory Pea.*—This elegant herb is difficult to cultivate on account of its repugnance to moisture. It may be grown by preparing rich, rough loam and potsherds broken small in equal parts. A large-sized pot should have the drainage carefully arranged and filled with the compost, leaving a raised mound in the centre. Stand the pot full of soil in water until thoroughly soaked, then, having permitted the water to run off, sow a few seeds on the mound of the centre, and keep in a light place. The sowing time should be after the rainy season is over. In watering, see that the base of the stem is not touched, and that a soaking is given when the soil is dry.

¹ *Crotalaria*, from *krotalon*, a rattle, alluding to the rattling seeds in the pods; *junce*a, like the sedge plant, *juncus*.

² *Clianthus*, glory-flower; *Dampieri*, in honour of the celebrated navigator.

CLITOREA TERNATEA¹—*Uparajita, Nila-dintana, Gokrán, Gokrána-mal*.—This beautiful climber, with large blue or white flowers, is of easy culture from seeds in any fair garden soil. Double-flowered varieties occur. Its root and powdered seed act as a purgative.

DESMODIUM GYRANS—*The Telegraph Plant, Gora-chand*.—An erect, short-lived, woody plant, native of moist districts, such as Kanara and Northern Bengal; interesting on account of the motion of the two smaller leaflets. During moist weather, while the sap is active, certain cells at the base of the leaf-stalk become, now turgid, now flaccid, as the sap passes, producing a jerky motion of the leaflets like the semaphore signal. It is propagated by seed, which should be sown at the beginning of the rainy season, and watered freely when dry.

DOLICHOS LABLAB—*Pauti, Wál, Valpapri, Shwet seem*.—Several varieties of this vegetable are in cultivation which differ in the colour and size of the seeds and the colour of the legume and flowers. The sort most valued has white seeds and very pale green pods; it is much grown near Surat, where it is sown at the end of the rainy season, and the unripe pods are sent to Bombay during the cold season, packed in shallow baskets. This plant is hardy and prolific, and thrives with the culture detailed for the Pea.

DALBERGIA SISSOO²—*Shisam, Sissoo*.—A tree useful for road-side planting, because it may be safely transplanted when of large size, and is of rapid growth. It may be propagated from seed or from the very numerous shoots that spring up when a tree has been cut down. Native of Afghanistan. Its timber is of little value.

¹ *Clitoria*, from a fancied resemblance to the *clitoris*; *ternatea*, said to be from Ternate, a Moluccan island.

² *Dalbergia*, after Nicholas Dalberg, a Swedish botanist; *sissoo*, the vernacular name.

DIALIUM OVOIDEUM—*Gal-siyambala Kallupullium*.—A tall Ceylonese tree, bearing clusters of velvety fruit resembling the filbert, and having a pleasant acid pulp surrounding the seed. It is said to thrive in the low country of Ceylon in a dry district. Seeds are procurable at Paradeniya.

DERRIS SCANDENS—*Mota sirili, Noa-luta, Noël-valli*.—A charming climbing shrub, having alternate compound leaves of 7 to 9 leaflets of deep green colour and increasing in size outward, the largest 2 by 1 inches, and from April to July bearing abundant racemes of small white or pink pea-like flowers.

DICHROSTYCHOS CINEREA—*Segum kati, Vertuli, Vada tulla*.—A small tree with leaves resembling those of the *babul*, but of an ashy gray colour, and pendulous flower spikes, of which the upper part is pink and the lower yellow, caused by the change in colour of the stamens as the flowers increase in age. It occurs in the Deccan, and flowers during the rainy season, beginning when two years old. Is propagated by seed.

DIPTERYX ODORATA, *Tonquin Bean* (of Guiana).

ERYTHRINA¹ **CRISTA-GALLI**.—Several forms of this plant are in cultivation. In select varieties the flowers are bright crimson, and the plant proves very satisfactory when properly pruned; in January, the branches should be pruned to 2 inches of the old wood. Growth sets in during March, and the flowers are produced at the ends of the newly-formed branches at the beginning of the monsoon. A few of the plants should be pruned a second time, at the end of May, by cutting the new shoots back to within 4 inches of their origin; those will flower later in the season. If shaded or crowded, the foliage becomes unsightly in autumn from the effects of "thrip," which should be kept down by washing with kerosene mixture. 2,000 to 7,000 feet altitude, with light rainfall, is specially suitable.

¹ *Erithrina*, an allusion to the red colour of the flowers.

ERYTHRINA INDICA PARCELII is a yellow variegated form of the common *Pangara*; it is ornamental while the leaves are young, and thrives in a moist soil, notwithstanding excess of salt.

FIJI CHESTNUT—*Inocarpus edulis*.¹—A large tree with unifoliate, leathery, leaves and yellow flowers resembling those of *Dalbergia*, in axillary spikes; the roasted seed tastes like chestnuts. The sap yields a red colouring matter, *Inocarpin*. The tree grows fairly in the alluvial soil of Calcutta Botanical Garden.

FENUGREEK — *Methi*, *Vendayam*, *Mente*, *Trigonella foenumgraecum*.—A bitter herb, greatly valued by those accustomed to it. It is most highly valued while in the seed leaves, and is commonly gathered when 4-6 inches high. A very sandy soil, with water sufficient to keep the ground moist, with protection from strong sunshine, and heavy rain and sowings at weekly intervals, are desirable. For seed, sowings are made in dry districts at the beginning of the cold season, in open ground, watered when dry. Horses are so fond of the crushed seed, that medicine may be given with it.

HÆMATOXYLON CAMPECHIANUM² — *The Logwood Tree*.—This pretty tree thrives in Deccan gardens, and makes an efficient fence in good soil with irrigation while the trees are young. Its flowers are bright yellow, odorous, and produced during October.

LEUCÆNA GLAUCA — *Kubabul*. — A small unarmed tree, having leaves like those of the *babul*, but larger, and globular heads of white flowers, succeeded by smooth, persistent seed pods 5 inches by $\frac{1}{2}$ inch.

LONCHOCARPUS BARTERI.³—A woody climber of tropical Africa, resembling *Wisteria chinensis*. It grows

¹ *Inocarpus*, fibrous fruit; *edulis*, eatable.

² *Hæmatoxyllon*, blood-coloured wood; *campechianum*, from Campeachy.

³ *Lonchorarpus*, referring to the lance-shaped fruit; *Barteri*, Barter's.

freely with ordinary treatment at Poona, and flowers after it has attained considerable age.

LATHYRUS ODORATUS¹—*The Everlasting Pea*—is a perennial herb which grows nicely against a wall facing north at 3,000 to 7,000 feet altitude, and yields abundant blush, rose, red, or white flowers, if protected from heavy rain and direct sunshine.

LUCERNE—*Medicago sativa*, *Walayeati-ghas*, *Alfalfa*, *Risku* (Cabul).—As a forage crop, nearly always ready for use, and yielding a large quantity of green food per acre, we have nothing to surpass *Khelat Lucerne*. The ordinary yield of this crop in the neighbourhood of Poona is at the rate of 50 tons per acre yearly, while free from green fly. The culture of *Lucerne* is very simple: Select a piece of good, rich ground, with the means of irrigation and abounding with lime; prepare the ground by manuring heavily with rotten sweepings at the beginning of the rainy season; plough or dig several times during dry weather, so that weeds may be destroyed; towards the end of the rainy season, lay out the ground for irrigation. The size of the water beds will depend on the level of the ground and the head of water available; if the ground be very flat, and a good stream available for irrigation, the beds may be 50 by 100 feet; if the ground is sloping, the beds must be smaller, and these also should be smaller if the irrigation water runs slowly, as a portion of a large bed would absorb the whole of a slow-running supply and prevent it from covering the whole bed within a reasonable time. In districts with heavy rainfall, September–November is the most favourable season; if the rainfall of the district be less than 30 inches, early sowing is sometimes desirable. Heavy showers of rain during the first month after sowing are injurious, and water covering the crowns of the plants for a few days will kill this crop. Sow the seed in lines

¹ *Lathyrus*, from *laturos*, the old Greek name of the pea; *odoratus*, sweet-scented.

1 foot apart; the common native seed drill is excellent for this purpose, but if only a small quantity is required to be sown, the lines may be made with a pick or similar implement, or it may be sown broadcast; mix the seed with fine sifted manure, to assist its regular distribution; let the drills be $1\frac{1}{2}$ inches deep; and sow 10 lbs. to the acre for the Deccan and other dry parts of the country where the crop lives about three years; for the Concan and other places, where the rainfall is over 60 inches yearly and sufficient to kill the crop, sow 25 lbs. to the acre. It will be understood that sound yellow seed is intended; if mixed with dead seed, the quantity must be increased proportionately. It will spring up in about ten days, and seven weeks after sowing will be ready for the first cutting: take care that a sharp reaper is used, so as not to pull the young plants up by the roots, and afterwards cut once monthly, or just before the flower appears; if permitted to blossom, the stalks become hard and indigestible, and the plant is weakened. After each cutting, the ground should be weeded, and after every alternate cutting, manure should be dug in. The quantity of water required for this crop depends on the quality of the soil; 70 tons per acre weekly is a fair quantity; but if the soil is perfectly drained, 100 tons per acre weekly may be given with advantage; if the soil be deep alluvial with water near the surface, much less irrigation will answer, as the roots will go to a depth of 10 feet seeking water. Other varieties of *Lucerne* are of less vigorous growth, and have a smaller seed, which is cheaper than the *Khelat Lucerne*. If a good sort has been secured, save seed from one plot yearly; the plants may die in producing seed, but the crop is valuable.

LUPINUS MUTABILIS grows freely at any altitude if sown in autumn, but only with 4,000 or more feet altitude, and protection from sun and rain, is the blossom satisfactory.

MUNDALEA SUBEROSA—*Supti*.—A stout shrub with corky bark, densely silky on the branches and beneath

the leaves. The leaves of six to ten pairs, of oblong, lanceolate, leathery leaflets, $1\frac{1}{2}$ to 2 inches in length, and lilac or rosy flowers in close terminal pendulous racemes, succeeded by a long silky pod contracted between the seeds, containing six to eight kidney-shaped seeds, which are used to poison fish. A very pretty shrub, native of the Western Ghats.

MYROXYLUM TOLUIFERUM—*the Tolu Balsam Tree*.—This valuable tropical American tree grows well with garden treatment at Bombay and at Poona, and forms a handsome tree, with pinnate leaves having pellucid streaks and dots. It seems probable that it will grow as a roadside tree in moist districts. The seed is distributed by the Agriculture and Horticulture Society, Madras.

NEPTUNIA OLERACEA.—An annual herb floating in tanks of the tropics. It has bipinnate leaves, which are sensitive, and yellow flowers.

NEPTUNIA TRIQUETRA is perennial and terrestrial, but resembles the above.

PACHYRHIZUS ANGULATUS—*the Yam Bean*.—A climber like *Chowli* or French Beans, but having tuberous roots. It thrives anywhere with heat and good soil.

PANOCHAETES COMMUNIS (of Himalaya) is a dwarf creeper with clover-like (trifoliate) leaves and cobalt blue pea-shaped blossom, which appear during the cold season.

PARKIA BIGLANDULOSA¹—*Chenduphul*—is common in our gardens. It has white bark; feathery foliage of twice pinnate leaves having forty to sixty pinnæ, 3 to 4 inches in length; pumules $\frac{1}{4}$ by $\frac{1}{4\frac{1}{2}}$ inch, 150 to 200 to each pinna; two glands on the petiole; and the flowers

¹ *Parkia*, in honour of Mungo Park, the African traveller. *Biglandulosa*, referring to two small glands on the petiole.

in pendulous balls, $1\frac{1}{2}$ inch in diameter, hanging from a long stalk. This tree thrives in any garden soil if watered while young, and is propagated from seed.

PARKINSONIA ACULEATA—*Eri-babul*.—A small tree, useful as a fence in dry soils. It has bright yellow flowers, and each leaf formed of 2-4 long pinnæ with small, decidulous leaflets.

PHASEOLUS LUNATUS—*the Lima* or *Double Bean*—is a climber which bears heat well, and may be grown in the hot season if necessary. Imported seeds in England have been found to contain hydrocyanic acid and to poison cattle, but that is probably after fermentation.

THE GARDEN PEA—*Pisum sativum*.¹—At any altitude over 2,000 feet, the white varieties widely cultivated in the tropics may be sown any time between May and January if the rainfall is not over 40 inches. With a higher rainfall, it is advisable to defer sowing till the rainy season is over. A rich, *deeply cultivated soil* that has been heavily manured for a previous crop, and contains at least 5 per cent of lime, is necessary to produce a good crop. It is very important to cultivate the soil deeply for this crop, in order to induce the roots to go far down where water is steadily available. When this is done, and water regularly given, the much-dreaded mildew has much less effect than otherwise: the plants outliving the enemy and bearing nearly as well as if mildew had not attacked them.

To attain this deep culture it is, in many soils, desirable to manure and dig all over, then mark the ground into spaces 4 feet in width, and throw the soil from the two proximal halves of two spaces on to the intervening space, thus doubling the depth of good soil. This is known as the "lazy bed system." Two double rows of seed are planted on the prepared bed, and a water-channel made in the centre.

¹ *Pisum*, from the Celtic for a pea. *Sativum*, cultivated.

The sowing season depends on the rainfall, as long continued rain destroys the crop. In dry districts, sowing may be begun in May with free irrigation and shade for the seed bed, small hardy white varieties being planted, with green leafy branches set between the rows of seed. Repetition sowings are made once in fifteen days till December, and the large green varieties planted only in the later seasons when the weather is cool. 1 inch apart is a suitable distance between the seeds, and 2 inches deep is advisable; the rows of seed being 1 foot apart and 2 feet between each pair on the raised bed. 10 lbs. of seed produces an ordinary family supply.

PITHOCOLOBIUM DULCE—*Vilayti-chinch*— is a large tree in a rich soil, and producing abundant twisted pods containing seed, partially enclosed in sweetish edible white pulp. It makes an excellent fence on a deep soil.

PITHOCOLOBIUM SAMAN —*the Rain Tree*— is of rapid growth in good soil with water, and yields a pod having abundant sugary pulp. Its name, "Rain Tree," is derived from the falling liquid excreta of cicadææ insects, which abound on the tree in Central America. Raised from seed.

PELTOPHORUM FERRUGINEUM.—A tall tree of rapid growth, from Molucca. The leaves are alternate, twice pinnate, and the flowers bright golden. A specimen in Madras Agri-Horticulture Society Garden attained 40 feet in height in six years. It also thrives at Bombay and Calcutta.

POINCIANA REGIA¹—*Gul-mohr*.—This Madagascar tree is of easy culture, and may be transplanted while of very large size. To prepare the seed for germination place it in an earthen pot and bury it in a moist dung pit about four months before the monsoon is expected.

¹ *Poinciana*, in honour of M. de Poinci, Governor of the Antilles in the middle of the seventeenth century. *Regia*, royal.

It is said this tree is of easy propagation by cuttings in Sind. The *Gul-mohr* is so common that it is little valued, but individual trees have fine flowers. One at Ganesh Khind had one petal pure white and four bright crimson. Such striking forms should be propagated by cuttings or grafting.

POINCIANA ELATA—*Sandeshra, Sankeswar*.—An interesting tree resembling the *Gul-mohr*, but having yellow flowers with long red filaments. It grows freely in various climates and is often planted at tombs, and is considered of value in medicine.

SARACA INDICA¹—*Asok, Usok, Diya-rat-mal*.—This graceful tree thrives equally on the Western Ghats and near Calcutta without special irrigation, and in Poona gardens with regular watering. It thrives with a moist climate, and being delicate while young is not as abundant as it should be. It is propagated by seed, which is large, thin-skinned, and soon loses germinating power.

SESBANIA GRANDIFLORA²—*Augusta, Agati, Baka, Hadga, Yerra-avesi*.—A short-lived tree of rapid growth, having large white or red pea-shaped flowers containing abundant nectar. The flowers and young pods are used in curries. *Yerra-avesi* and *Basna* imply the red sort, and *Sada-basna* or *Telli-avesi* the white form.

SENSITIVE PLANT—*Lazalu, Lajuk, Mimosa pudica*—is a weed in South India and Ceylon, but from Madras northward may be cultivated in the shade of trees as an interesting subject; it is recommended as a useful green manure in southern districts and Ceylon.

SOPHORA TOMENTOSA.—A North-American shrub having pinnate, hoary leaves, with eleven to seventeen leaflets and erect racemes of golden pea flowers. It grows nicely from 2,000 to 7,000 feet altitude, and may be increased from seed.

¹ *Saraca*, said to be from a vernacular name. *Indica*, from India.

² *Sesbania*, from *Sesban*, the Arabic name of *Sesbania Ægyptica, senneri. Grandiflora*, large-flowered.

SWEET PEA—*Lathyrus odoratus*.—A favourite annual in temperate climates, is very shy in flowering over the greater part of India. At Nagpore and Chinsurah it flowers if sown at the end of the rainy season, and at Mahableshwar it flowers at Christmas if sown in October.

TAMARINDUS INDICA¹—*the Tamarind Tree, Amli, Chinch*.—This tree delights in a deep alluvial soil, and in such a position forms a handsome landscape tree. It will also grow on decayed trap soils where few trees will thrive without free watering.

TEPHROSIA CANDIDA.²—A low shrub from tropical Himalaya, having slender branches with velvety pubescence. Leaves short petioled, attaining 6 to 9 inches in length; leaflets nineteen to twenty-five, ligulate acute, 1½ to 2 inches in length, smooth above, silky beneath; and racemes of pure white flowers, 1 inch in width, produced at the end of the rainy season. A very pretty shrub, thriving with ordinary treatment at Poona. Propagated by seed.

VOANDZEIA SUBTERANNEA—of Africa—has alternate trifoliate leaves on hardy sprawling branches, and fruit which it buries in the ground as does the common ground-nut. Its fruit contains one hard, starchy seed of the size of a pea, from pale yellow to black, with a black hilum. It is recommended for culture as being a perfect food; it is soaked overnight and boiled.

VIGNA CAPENSIS—*Halounda*—the “sweet pea” of Western India. A very beautiful flower which grows wild in fences at 4,000 feet altitude. The root is tuberous and edible.

VIGNA CATIANG—*Chowli*—a sub-erect plant; and **V. CHINENSIS**—a climber, with large purple flowers, buff

¹ *Tamarindus*, from *tamur*, Arabic for a ripe date. *Indica*, India.

² *Tephrosia*, from *tephros*, ash-coloured, referring to the colour of the leaves. *Candida*, white, the colour of the flowers.

on the outside. Both bear pods averaging 9 inches by $\frac{1}{2}$ inch, and are greatly valued as green-pod pulse, eaten like French beans. Are grown in river beds with melons. Sown in January, it yields pods during the hot season.

WISTARIA CHINENSIS.¹—A climbing shrub, bearing leaves with six to eight pair of ovate, acuminate, silky leaflets, and dense pendulous racemes of pea flowers in lilac tints. It thrives in Tirhut and at hill stations with moderate rainfall.

WAGATEA SPICATA²—*Vagati*, *Vakeri*.—A highly ornamental, robust, woody climber, armed with recurved prickles. The leaves are large, twice pinnate; and the flowers form a dense spike, sometimes 2 feet in length, yellow, but becoming crimson with age, so that spikes with the lower half crimson and the upper yellow are common. The flowers appear during the cold season, and are succeeded by pods about 2 inches by $\frac{1}{2}$ inch, which contain 20 per cent of tannin. Under its old name, *Caesalpinia*³ *digyna*, this has lately come to notice as a new source of tannin. Mr. G. M. Woodrow got the pods analysed in 1872.

ROSACEÆ,⁴ *The Rose Family.*

An important natural order, rich in luscious fruit, beautiful and fragrant flowers. As types of the family, the rose, apple, pear, loquat, peach, and strawberry are sufficient. This family are chiefly found in temperate climates, but many are cultivated widely. Cuttings are the chief means of propagation, and select varieties are

¹ *Wistaria*, in honour of Caspar Wistar, 1761—1818, Professor of Anatomy at the University of Pennsylvania.

² *Wagatea*, from the vernacular name. *Spicata*, having flowers in a spike.

³ *Cæsalpinia*, from *sessile*, on the axis.

⁴ *Rosaceæ*, from the genus *Rosa*, Latin for rose.

often grafted (by budding) on to common sorts. Seeds in this family are irregular in germinating; some of the seed will sprout soon after being sown, other seeds of the same lot may take a year or so to germinate.

THE ROSE. Throughout the dry parts of India roses can be grown with fair success, but on the sea-board, where the rainfall is heavy, extra care is required to prevent water lodging about the roots during the rainy season; and the moist condition of the atmosphere keeps the plants growing without rest, and in consequence they are short-lived.

The extra large roses to be seen at exhibitions are obtained by selecting an extra vigorous rose tree with flower buds just formed and very small, the most promising bud is retained and all others removed; and any watering is with clear liquid. When well developed and about to open, a shade is erected over it, which will keep off rain and excessive sunshine, the plant being fed meanwhile with liquid manure. An occasional watering with a 1 per cent. solution of sulphate of iron, *hiracas*, is beneficial to roses in soils wanting in soluble iron.

Soil.—A deep well-drained loamy soil of a firm texture such as the black soil of the Deccan or the alluvium from the banks of rivers is well suited for roses in the open ground. It should be enriched with a liberal supply of manure, and for potting purposes may be freely mixed with sand or crushed brick.

Propagation.—Many varieties of roses root freely from cuttings, and plants raised by that means are to be preferred for pot culture. The cuttings should be about four inches long, of well ripened wood, cut at the lower end close to a bud, and inserted about half their length in very sandy soil in a shady place and watered slightly every alternate day. If well-ripened wood can be procured any season may serve, but the cold season is generally most favourable.

The pink rose, EDWARD, the *Gulab*, or rose of the people over a wide region, makes an excellent stock for budding more delicate sorts upon. It endures heat, and its vigorous upright growth permits of rose trees with a clear, straight stem 3 to 4 feet in height ("standards") or 1½ to 2 feet in height ("half standards") being produced without the use of stakes. In hot climates, rose trees raised from cuttings or layers—on own roots—are more durable than grafted plants, but none may be expected to live many years if a distinct season of rest be wanting.

Pruning the rose requires considerable knowledge of the various classes and often of the habit of particular varieties. In all kinds, weakly or malformed shoots, or such as are decayed at the points, should be cut out from their origin, and crowded branches thinned. In the Noisette class, which includes the yellow roses Lamarque and Solfaterre and Marechal Niel, which thrive so well in hot climates, the weakly shoots should be cut out and the strong ones reduced by about a third of their length. The proper season for this operation is when the tree is at rest during April. As this class of rose bears flowers on side-shoots as well as at the ends of the branches, the ends of long rampant branches may be pinched off during the growing season with advantage.

The HYBRID PERPETUAL—better named *remontant*, bloom once, then rest awhile and bloom again—class of roses, which includes many of the rich dark colours, is benefited by severe pruning during the season of rest in April-May. At this season all the shoots of the past season should be cut in till within about six inches from their origin, and if a crowd of shoots break out, all but three, well separated, should be rubbed off. As this class mostly produces flowers at ends of strong shoots, these should be left intact until they have flowered, then a few of them should be cut back as before; this prolongs the flowering season, but if too many are cut back, it will weaken the tree.

MOSS ROSES are distinguished by the calyx leaves being much dissected and glandular, giving a special elegance to the bud and by delicious perfume. Pruning and general treatment similar to Hybrid Perpetuals.

TEA-SCENTED ROSES are so varied in their habit that almost every variety requires different treatment, yet it will serve our purpose to divide them into two classes—the strong-growing, such as Marechal Niel and Gloire de Dijon, which should be treated as before detailed for Noisette roses, and the moderate-growing, such as Reine de Portugal, should have the shoots that have flowered cut back to within four buds of their base, and all weakly branches cut out from time to time during the growing season.

CHINA ROSES may have the branches that have flowered cut back several times during the growing season.

BANKSIAN ROSES are climbers producing small flowers in clusters; they should have strong rampant branches cut back one-third of the length after flowering, and weakly shoots taken out from the base.

SWEET BRIARS are small roses with exquisitely perfumed foliage; they require little pruning, and thrive if budded on to the rose Edward.

BOURBON ROSES.—This class, which includes Souvenir de la Malmaison and several other general favourites, requires little pruning beyond taking off the ends of shoots that have flowered, and cutting out such as are weakly.

Roses are often grown in pots and tubs and placed on garden paths, and the result is deplorable. The extremes of drought and moisture that succeed each other at short intervals are very prejudicial, and the constant watering that is required is a waste of labour. If it is necessary to keep roses in pots, they should be sunk into the ground till the rim of the pot is near the surface; by lifting the

pot occasionally, the roots will be prevented from making their way into the surrounding earth; fresh soil should be given during the cold season.

RUGOSA ROSES—*Rosa rugosa* (from Japan)—is the source of a class of decorative roses having branches closely beset with straight slender prickles and bearing leaves 3 to 5 inches in length with nine leaflets having deep wrinkles on the veins and single or semi-double rosy or white flowers, succeeded by large bright crimson fruit. Pruning in this class is restricted to cutting out shoots that have flowered and fruited during several years and show signs of decay or overcrowding.

MUSK ROSES—*Rosa moschata*.—The Musk rose of the Naga hills is a vigorous climber, with single pure white flowers.

WICHURIANA ROSES—*Rosa wichuriana*—have long trailing shoots with almost evergreen foliage and white flowers with prominent yellow anthers.

ROSA INVOLUCRATA.—A subschant, pure white, large, fragrant, single rose; native of Bengal, near Maldah, altitude 130 feet, and of Nepal. The branches are stout and armed with straight stipulary prickles, young shoots villous. The leaves with 5 to 11 serrate leaflets, villous beneath, the largest about 1 by $\frac{1}{2}$ inch. Now that public taste has so far improved as to value "single" flowers as they deserve, this beautiful Indian species may be expected more frequently in gardens than hitherto it has been found. It may be raised from seed as well as by the usual methods.

ROSA GIGANTEA (from Manipur and the Shan hills, altitude 7,000 feet), is an extensive climber with lemon yellow, single flowers 5 to 6 inches diameter. It may be cultivated in Northern India as low as 4,000 feet altitude.

ROSA BRACTEATA (from China) has pure white simple corolla 3 inches wide, and yellow stamens and leaves with about nine small leaflets.

SELECT ROSES.

The initials T., H.P., etc., indicate the class.

- | | |
|------------------------------|--|
| T. Abricote | Fawn, apricot centre. |
| B. Abicade | Pure white, large, full. |
| N. Aimee Vibert..... | Pure white, small, full. |
| HP. Alfred Colomb | Bright carmine red. |
| HP. Annie Laxton | Fresh rose, tinted orange. |
| HP. Antoine Ducher | Dark purplish rose, large and fine. |
| C. Archduke Charles | Shaded rose, changing to crimson. |
| T. Archimède | Rosy fawn, dark centre. |
| B. Armosa | Pink, a small rose, very free. |
| HP. Beauty of Waltham..... | Bright rosy crimson. |
| T. Belle Lyonnaise | Canary yellow, large full. |
| HP. Boule de Niège | White, good form, in clusters. |
| HC. Brenus | Deep carmine, large full. |
| T. Cathrine Mermet | Light rosy flesh colour, large. |
| HT. Captain Hayward..... | Carmine crimson, large petal. |
| HP. Charles Turner..... | Brilliant red, large. |
| HP. Captain Christy | Very pale, flesh colour. |
| HP. Caroline de Sansal | Clear flesh colour, edges blush. |
| N. Céline Forestier | Citron yellow. |
| HP. Centifolia rosea..... | Bright rose, very large. |
| N. Cloth of Gold | Yellow, large, double. |
| P. Crimson Rambler..... | Crimson - scarlet, small, in clusters. |
| HP. Countess of Rosebery ... | Brilliant carmine rose, large, full. |
| T. Devoniensis | White, yellow tinted. |
| " (climbing)... | " " " |
| T. Duchess of Edinburgh .. | Crimson, free flowering. |
| HP. Edward | Fine pink, a free-growing stock. |
| Fairy Rose | Very small, double rose, excellent edging. |
| HP. Ferdinand de Lesseps ... | Rich crimson. |

- HP. Frau Karl Druschki.....Pure white, large, full.
 HP. General Jacqueminot...Brilliant red, velvety.
 HP. Géants des bataillesRich velvety crimson.
 HP. Gloire de SanteneyRich crimson.
 T. Gloire de Dijon.....Yellow, shaded salmon or buff, very fine.
 T. GoubaltBright rose, centre buff.
 HP. Horace VernetVelvety crimson, large, full.
 P. InermisSmall pink, in large clusters, few thorns.
 T. Isabella SpruntDeep canary colour.
 HP. Jean GoujanDeep carmine rose.
 HP. John HopperBeautiful carmine.
 HP. La Duchesse de Morny Clear light rose.
 La FrancePale peach, rose centre, very large.
 N. LamarqueWhite shaded, sulphur yellow at centre.
 T. Le PactoleCream yellow, shaded blush.
 HP. Lord MacaulayRich velvety crimson.
 HP. Lord RaglanRich carmine, tinted with violet.
 T. Louise de SavoieFine yellow, large, full.
 T. Mad. de St. JosephsSalmon pink.
 T. Mad. de TartusDelicate pink, large.
 T. Mad. CamilePink, veined with white.
 HP. Mad. Eugene Verdier...Bright rose, large, full.
 T. Mad. Falcot.....Orange and yellow, large.
 HP. Mad. HalphenWhite, salmon pink, centre yellowish.
 HT. Mad. J. Combet.....Creamy white, large, full.
 HT. MamieRosy carmine, yellow at base of petals.
 T. Mad. Margottin.....Deep citron yellow, centre rosy peach.
 T. Mad. WillermozWhite, centre salmon.
 HP. Maurice BernardinCrimson, shaded violet.
 C. Mrs. BosanquetPale flesh colour, clustering.
 HP. Mrs. Charles WoodBright red, large, full.

- HP. Mrs. VeitchBright rose, large, deep petals.
- T. Marechal NielBright golden yellow.
- T. NiphetosVery pale lemon.
- T. „ (white)Pure white.
- HP. Paul NeronDeep pink, very large.
- T. Perfection de Mont-plaisirCanary yellow, very fine.
- T. Reine de PortugalDeep golden yellow, centre salmon.
- HT. Reine Marie Henriette Rosy pink, long pointed buds.
- HT. Robert ScottRosy pink, large.
- C. Rosa MundiRed, striped white, small.
- T. Safrano.....Apricot yellow, free blooming.
- N. Solfaterre.....Sulphur yellow, large, double.
- T. Souvenir d'un AmiSalmon and rose.
- Souv. de la Malmaison...Pale flesh colour.
- Sweet Briar.....Sweet-scented foliage.
- ThaliaPure white, small, in clusters, rambling.
- T. The Lion.....Rich crimson, single, rambling.
- T. Vicomtesse de Cazes ...Yellow, centre tinted copper.
- HP. Victor VerdierRose with shaded carmine.
- N. White Marechal Niel ...Creamy white.
- W. Wichuriana.....Single white with yellow anthers, fine foliage.
- Xavier OliboVelvety crimson, shaded amaranth.

An *Artificial Manure* specially recommended for rose trees has—

Superphosphate of Lime,	-	-	12
Nitrate of Potash, -	-	-	10
Sulphate of Magnesia, -	-	-	2
Sulphate of Iron, -	-	-	1
Sulphate of Lime, -	-	-	8

Use $\frac{1}{4}$ lb. per square yard. The ingredients should be applied separately to the soil, else an evil gas may be developed.

Pests of the Rose Tree.—Mildew, Greenfly, Aphis, Scale, Caterpillars, and Chafer Beetles, are treated under their respective headings.

THE ALMOND TREE—*Prunus amygdalus*.¹—The true almond tree is easily raised from fresh almonds imported from the Persian Gulf, and is very showy, when in flower, with its numerous rosy blooms, but does not fruit in India without a distinct season of rest; and the same must be said of the apricot *Prunus armeniaca*, except in a few places far north with a specially cool climate during winter.

THE PLUM.—*Alucha*, and its indigenous varieties, *Shalimar* and *Bokhara*, thrive in Lahore gardens, but the greengage and other superior sorts are cultivated above 5,000 feet altitude. It is the need for rest during winter that controls the cultivation of this and so many other Rosaceous fruits.

APPLE—*Pyrus Malus*.²—The apple tree grows freely at the altitude of Poona, 1,800 feet, but does not give fruit worth the time and trouble required to obtain it, because the climate is hot throughout the year and the trees do not get the rest necessary to form good fruit. At Bangalore, altitude 3,000 feet, the apple bears well. The chief points in apple cultivation are a deep, loamy soil, the trees about 12 feet apart, and in a plot by themselves, so that irrigation may be given or withheld, as is desirable. A thorough resting during October, brought about by withholding water or either by opening the

¹ *Prunus*, the name used by Pliny for the plum tree. *Amygdalus*, from *amyo*, to fret or wound, in allusion to the shell of the nut having fissures.

² *Pyrus*, from the Celtic for a pear. *Malus*, the name for the apple used by Varro.

roots and pulling off the leaves or by root-pruning—that is, digging round the tree at a distance of from 2 to 4 feet from the stem, in proportion to the size of the tree, and cutting about half the roots that extend beyond the line. It is advisable to divide the circle at the base of the tree in four parts, the east and west quadrants may be pruned one year, and the north and south the following year. The pruning of dead and weakly branches, and of a third of the length of all long, soft shoots, must be attended to at the same time. A heavy supply of old manure after the fruit is set, and abundant watering once in three or four days during the next two months, will be necessary. As the fruit begins to ripen, water should be reduced.

The following sorts are in cultivation:—

Cox's Orange Pippin.	Golden Kenneth.
Devonshire Quarrendon.	Hawthorden.
Dutch Codling.	King of Pippins.
Duke of Devonshire.	Royal Pearman.
Wellington.	

PEACH—*Prunus persica*.—The peach as it occurs in India compares unfavourably with select varieties cultivated elsewhere, and the mere importation of young trees of reputed sorts has not induced much improvement. Cross-breeding, and the selection of varieties for local climates, is much wanted, and the careful perusal of the notes on that subject are specially recommended to the intelligent classes throughout the region of the monsoons (see *Cross-breeding*).

The Peach (*Shuft aloo*, *Aroo*) thrives in an altitude of 3 to 4,000 feet with very little, if any, irrigation, and at 1,000 feet altitude with irrigation. At low altitudes it is generally necessary to arrest growth when the rainy season is over, to induce flowering. For this purpose, the common plan is to take the soil out from the roots, leave them exposed, and withhold water—a thorough digging with a sharp grubber will have the same effect—

most of the leaves will fall off. At the same time, the weakly, wire-like shoots that are always present in abundance, and decayed branches, as well as about half the length of long shoots of the past season, should be pruned away. When the growth has been sufficiently long arrested, the plump flower buds will appear. If the weather continues dry, a watering should be given; this causes the flower buds to open, and shortly afterwards a supply of old manure should be mixed with the soil withdrawn from the roots and the mixture returned to its place. After this, water sufficient to keep the soil moist should be given, and thinning the fruit attended to.

Thinning the Fruit.—It often occurs that trees show more fruit in a young stage than the tree is capable of bringing to maturity, and usually a large proportion of this fruit falls when half grown. This causes a distinct waste of material, which might have gone to the further development of the crop if a portion of the young fruit had been removed as early as practicable. Therefore, it is advisable to look over all young fruit carefully, and remove some wherever there appear to be an excessive quantity. How many should be retained is entirely a matter for judgment in presence of each individual tree, the principal object aimed at being regularity of produce in proportion to the strength of the branches.

The Public Garden at Lahore has usually a selection of varieties for sale.

In warm climates some sorts of apple may be propagated by cuttings prepared from the lower part of shoots taken from near the base of the stem, and the sorts that do not root freely may be grafted upon such as increase by cuttings. *Guti* layering may also be used during the rainy season by removing a ring of bark and fixing good soil round the wound with sacking and keeping the soil moist.

In some climates a difficulty occurs in distinguishing the apple tree from the pear tree, in the absence of flowers or fruit. The apple tree unrolls the young leaf

from one side to the other—that is, has *convolute veneration*; the pear tree unrolls from the upper face of the midrib toward both sides, or *involute veneration*.

THE PEAR—*Naspati*, *Pyrus communis*.—*Naspati*, although very hard when brought to market, makes an excellent stew. It bears fairly at 4,000 feet altitude, and “*Louise Bonne*,” “*Hughe’s Bergamot*,” “*Victoria*,” and “*Marie Louise*,” do fairly well from 5,000 to 7,000 feet altitude in the north, where the cold during winter is sufficient to set the plants to rest. The cultivation required is similar to that detailed for the apple.

QUINCE. - This tree grows and fruits well at an altitude of 4,000 feet, but it is not much valued. Its chief importance in England is as a stock to graft the pear on.

APRICOTS produce fruit freely in the Himalaya above 5,000 feet altitude, and also in Afghanistan, which is hot in summer and cold in winter. May is the time for ripening.

THE STRAWBERRY—*Fragaria*¹ *hybrids*.—This valuable fruit grows freely and ripens a few berries from little above sea level, but for practical success south of Bombay an altitude of 3,000 feet is necessary; in northern districts, much less altitude is suitable for the production of a fair crop; at Lucknow, altitude 370 feet, fair results have been met with. At Mahableswar, where the crop is a regular market production, the strawberry gardens are about 4,000 feet altitude and are sheltered from the south-west monsoon which breaks on the hill tops a mile or two from the strawberry gardens with an average of about 250 inches, chiefly from June to September, the remainder of the year giving about 10 inches, but the gardens only get about half that quantity.

The soil necessary is a rich friable loam containing 5 % to 10 % of lime, but not sandy or adhesive while wet; it must be at least 15 inches in depth, and on a sound

¹ *Fragaria*, from *fragrans*, sweet-smelling.

bottom which will admit of good drainage, yet not a *kunker* bed which will drain away all moisture. The soil of the Mahableshwar strawberry gardens is derived from disintegrated trap, locally called *muram*, and laterite, which has abundant iron. New plantations are made yearly, in September, with strong-rooted offsets obtained by dividing the old plants, or by runners when they can be procured strong enough. The plants are set 15 to 18 inches apart, and are planted firmly in highly manured soil, and when they have taken root fresh soil is drawn towards the plants and, while dry, trodden firmly about the roots. Strawberry beds in the tropics usually need to be renewed yearly; in a few instances the plantations may stand over several years, as in temperate climates, but this cannot be relied on for crops, because the dung beetle may get to the roots and a fungus having copper-coloured spores like the "rust" of wheat, is very destructive. As the vegetative body of the fungus is in the tissues of the strawberry plant and the effect is produced before the "rust" appears on the leaves, it is very difficult to heal. Fire, to destroy all affected plants, and rotation of crops to leave the fungus spores (seeds) without a suitable host for a year or two, is advisable.

Rich manuring, having especially phosphoric acid and potash as well as the essential nitrates, as is found in the homestead refuse heap, applied to the soil previous to planting, and weak liquid manure at short intervals after the flowers appear, with $\frac{1}{4}$ inch of water over the surface per week, is necessary either as rainfall or irrigation.

Strawberry sorts are very numerous, and good varieties may be raised from seed, which is very irregular in germination; and, because a few seeds only sprout at once, it must not be treated as bad seed, as it continues sprouting at intervals for a year or so, and local races, adapted for special soils and climates, may be raised by cross-breeding sorts that thrive in a particular climate with more select sorts that refuse to bear fruit under local conditions.

Artificial Manure for the Strawberry.—A mixture containing nitrogen, 4·05 %; potash, 18·20 %; phosphoric acid, 17·15 %, applied at the rate of 4 oz. per square yard, has been found suitable.

FRAGARIA INDICA.—The small yellow-flowered strawberry of the Nilgherries is useful for covering sloping banks with foliage. It is propagated from runners.

RUBUS LASIOCARPUS¹—*The Raspberry of the Western Ghats, Rajpuri, Gauriphal.*—This fine fruit is of easy culture at an altitude over 3,000 feet, but at lower elevations does not repay the cost, although it grows well. At the proper altitude cuttings of the lower part of the stem put in during the rainy season bear fruit during the following hot season if the weeds are kept down. At the annual dressing, about the end of the rainy season, the stems that have fruited may be cut down, and any that have not fruited should be arched over and tied to those of an adjoining plant; they will probably fruit early the following season.

RUBUS ROSAEFOLIUS²—*Himalayan Raspberry.*—A small bramble-like plant bearing double white flowers like miniature roses during the cold season; has long been established in Calcutta gardens. Its habitat extends from the Himalaya to Java, therefore its cultivation in hot climates presents no difficulty. Propagation by division.

LOQUAT—*Eriobotrya japonica*.³—This fruit-tree thrives in the Northern Provinces, and in Western India is delicate, but when planted in sandy loam soil kept at an equal state of moisture bears fruit well in the Deccan. Plants raised from seeds are little value, therefore the seedling plants should be grafted to a select variety. The

¹ *Rubus*, from the Celtic for red; *lasiocarpus*, having hairy fruit.

² *Rosaefolius*, having leaves like the rose.

³ *Eriobotrya*, from *erion*, wool, and *botrys*, a bunch, in allusion to the woolly branches and inflorescence; *japonica*, from Japan.

Loquat flowers nearly at the beginning of the rainy season and again towards the end; like the Vine, fruit produced from the later blossom ripens during the hot season.

SPIRAEA CORYMBOSA.¹—A shrub about 2 feet in height, having alternate simple leaves pale green, oval, wrinkled, and toothed near the apex, resembling the beech tree leaf. It bears in the hot season large corymbs of creamy white flowers. The northern side of a house and a regularly watered soil are desirable in growing this sweet little shrub. Propagation by division.

SPIREA AITCHISONII (of Afghanistan).—A large shrub with pinnate leaves and terminal panicles of small white flowers appearing during July–August. For Simla and other places of similar climate this grand plant is sure to be appreciated. Propagation by ripe cuttings from the base.

BRAYERA ANTHELLMINTICA—The *Koussa* or *Cusso* tree of Abyssinian mountains—has alternate but larger, and, like those of its relative the Rose, bearing the cicatrices of old leaves and the young leaves pressed to the points of the branches and small rose-like flowers, of one sex, on paniculate cymes. It grows on tropical mountains at 5,000 feet altitude. The drug is the female panicle; but it is not required where fresh root bark of the Pomegranate is available.

SAXIFRAGACEÆ,² *The Saxifrage Family.*

The Gooseberry, Hydrangea, and the Saxifrages are types of this small family. They are temperate climate plants which grow in the tropics at high altitudes, or sheltered from the sun in conservatories.

¹ *Spiraea*, the name used by Theophrastus, probably from *speiras*, to wind, in allusion to the fitness of the plants for garlands; *corymbosa*, having flowers in an expanding head.

² *Saxifragaceæ*, from the genus *saxifraga*, from *saxum*, a rock, and *frango*, I break, from its reputed efficacy in stone in the bladder.

ASTILBE RIVULARIS.—A handsome herb having twice or thrice-ternate leaves and leaflets 2 to 3 inches in length, and large panicles of small yellowish flowers. It is native in temperate Himalaya, and adapted for rock-gardens at 4,000 to 7,000 feet altitude. Propagated by seed or division.

The **GOOSEBERRY**—*Ribes grossularia*—grows in the shelter of pine woods in Afghanistan, above 6,000 feet, and might be extensively cultivated in Western Himalaya were it not that other fruits having similar acid properties are cheap.

The **RED CURRANT**—*Ribes rubrum*—and its white variety, the **BLACK CURRANT**—*Ribes floridum*—and the “**FLOWERING**” CURRANT—*Ribes sanguineum*—all thrive in Western Himalaya, about 5,000 feet altitude, with shade from mid-day sun, and are easily increased by cuttings planted in sheltered positions during autumn.

SAXIFRAGA SARMENTOSA.¹—A pretty hanging-basket plant, with circular, crenate leaves, hairy and red beneath (in the variety *tricolor*, blotched with creamy white), and suitable for the conservatory. Propagate by division.

HYDRANGEA HORTENSIS.²—An undershrub, attaining 1½ feet in height in hot climates, having opposite, broadly-ovate, serrate, acuminate leaves, and bearing large terminal corymbs of flowers in two forms, small fertile, and large sterile, the sterile flowers being developed calyx lobes only. The colour of the flower varies from pure white, through rose to blue. An altitude of from 4,000 feet to the frost line is suitable. The northern side of a house, regular watering, rich loamy soil, and pruning back to ripe wood after flowering, are desirable for its culture. Propagate by cuttings, in a close frame.

¹ *Sarmentosa*, producing long, naked branches.

² *Hydrangea*, from *hudor*, waters, and *aggeion*, a vessel, in allusion to the cup-shaped fruit; *hortensis*, of gardens.

CRASSULACEÆ,¹ *The Stone Crop Family.*

A small tribe of plants having very succulent leaves, and carpels usually as many as the petals, with a scale at the base of each. The separate carpels easily distinguish this family from *Portulacaceae*, which has a similar succulent habit,

BRYOPHYLLUM CALYCINUM²—*Amorshunkar, Hapalada-ala-gida, Jewanti, Pánphue, Ghaipat.*—A succulent, erect-growing, perennial herb, having opposite, simple or tripartite leaves and terminal panicles, with opposite branches bearing pendulous flowers, having a long-inflated calyx with four valvate lobes. This plant has spread widely in moist climates in the tropics, and is useful in teaching botany by showing the typical formation of the carpel to be a leaf bearing seeds on its margins. In a moist, slightly shaded position it requires no cultivation, and is propagated by the leaves, which fall and produce young plants from their crenatures. A specimen placed between sheets of paper, under a heavy weight, produced, at Poona, young plants from all the crenatures.

COTYLEDON SPATHULATA.³—A succulent plant, having a dense rosette of small leaves and producing a raceme of orange-red tabular flowers. It thrives at 4,000 to 7,000 feet altitude with protection from damp, and is used as an edging for flower-beds.

KALANCHOA FLORIBUNDA⁴—*Hapalada-ala-gida.*—A smooth, succulent perennial, having opposite, simple or

¹ *Crassulaceae*, from the genus *crassula*, from *crassus*, thick, in allusion to its leaves.

² *Bryophyllum*, from *bryo*, to sprout, and *phyllon*, a leaf, in allusion to its leaves giving out buds; *calycinum*, alluding to the remarkable calyx of the flower.

³ *Cotyledon*, from *kotyle*, a cavity, as in the hip-joint, in allusion to the form of the leaves of some species; *spathulata*, like a small spoon or *spatula*.

⁴ *Kalanchoa*, from the Chinese name of one of the species; *floribunda*, having numerous flowers.

ternate leaves of an olive-green colour, and producing cymes of clear-yellow octandrous flowers during the cold season. Used for flower-beds.

SEDUM SARMENTOSUM.¹—A dwarf succulent plant, useful for making a green carpet in a moist climate or in the conservatory. Its leaves are opposite or in fours, $\frac{1}{2}$ inch in length, linear, terete, or slightly flattened and pointed. Flowers, bright yellow, less than $\frac{1}{4}$ inch, in elongated cymes. As a dressing round the base of the stem of a tree, it does particularly well in Bombay. Propagated by cuttings.

COMBRETACEÆ,² *The Myrabolan Family,*

Is a small family, including some choice climbers and large timber trees. The climbers are propagated by layers and cuttings, and the trees by seeds. Planting in the ground, instead of pot culture, is specially desirable in this family.

QUISQUALIS INDICA³—*the Rangoon Creeper, Rangun-acha-vel, Bar-mashi, Lalachameli*—is a very showy climber. The flowers are sweet scented and change colour as age increases, therefore, flowers varying from white to crimson may be seen during its growth. Any good garden soil is suitable. Propagation by layers or cuttings.

COMBRETUM COCCINEA—*Poirrea*.⁴—An elegant climber, with dark-green shining, alternate, entire leaves, and large terminal clusters of small flowers. It thrives

¹ *Sedum*, from *sedeo*, to sit, in allusion to the dwarf growth ; *sarmentosum*, producing long shoots or runners.

² *Combretaceæ*, from the genus *Combretum*, a name given by Pliny to a climbing plant.

³ *Quisqualis*, from *quis*, who, and *qualis*, of what kind—a natural exclamation on finding a strange plant ; *indica*, from India.

⁴ *Coccinea*, red-coloured ; *Poirrea*, after Poivre, a French traveller.

in a mixture of two parts fibrous loam, one part leaf mould, and one part crushed shells, mixed with old cow-dung. It grows nicely in a tub shaded from high sun, but better if planted on the northern face of a house, from sea-level to 4,000 feet altitude.

The Chinese plant, *COMBRETUM SUNDIACUM*, has been discovered to be a cure for the opium habit. Some of the other members of the genus may have the same property. Where plentiful, they are worth a trial.

COMBRETUM GRANDIFLORUM.—Except in the larger size of all its parts and its greater hardness, it is difficult to point out any characteristic in which this differs from *Combretum coccineum*. It thrives and looks well if cut back and kept in a shrubby form as a single specimen on a lawn. If permitted to run up the walls of a house, its flowers are produced almost out of sight. Propagated by layering.

*TERMINALIA CATAPPA*¹—*Bengali-badam*, *Deshi-badam*.—This handsome tree bears a fruit which resembles almonds, and as the latter fruit is also called *badam*, much confusion arises. *Terminalia eatappa* is valued for its shade and landscape effects, but its fruit is acknowledged to be inferior to the almond.

The Myrabolans, *Terminalia belerica* (the *Bherda* or *Helá*), *T. chebula* (the *Hirdá*), both with smooth nuts; *T. arjuna* (the *Arjun-sadada* or *Kahu*), *T. tomentosa* (the *Ain*), which have five-winged fruits, and feed the Lussah silk-worm; and *T. paniculata* (the *Kinjal* or *Honal*), with small three-winged nuts, are grand trees, but the odour of their flowers precludes their use in a garden. The *Dhaura* or *Dabria* (*Anogeissus latifolia*) is also a fine tree for moist climates, as its branches make convenient tool handles, the wood being tough enough for use as cart-axles.

¹ *Terminalia*, in allusion to the leaves growing at the ends of the branches; *catappa*, from the Malayan vernacular name.

MYRTACEÆ,¹ *The Myrtle Family.*

This family is represented by the Myrtle, Jambool, Rose-apple, Guava trees, and Blue Gum, and is easily recognized by the entire leaves, with translucent dots and a vein parallel with the margin of the leaf connecting all other veins. Opposite, entire leaves, without stipules, prevail, but Eucalyptus and other genera have the leaves opposite while young, and subsequently alternate. Any ordinary garden soil kept moist is suitable for growing the members of this family. Propagate by cuttings and seeds. The seed must in all cases be quite fresh. In the myrtle and jambool, it will germinate well if sown directly it is gathered from the tree.

BARRINGTONIA RACEMOSA—*Karpi*—with very abundant racemes of pink flowers, and B. ACUTANCULA—*Tiwar*—with pendulous racemes, 1 to 2 feet in length, of scarlet flowers, are grand trees for the banks of a stream or tank in a moist climate like that of their home, the Konkan.

BERTHOLLETIA EXCELSA²—*Brazil Nut*.—This seed is abundant in shops about Christmas. In a climate like that of Kanara, there is much probability of its growing well. To get the seed to germinate, it should be fresh, and filed until the shell is thin, and then planted.

CAREYA ARBOREA—*Kumba, Kumbi, Putta-tannimarum*.—A tree of the lower slopes of the mountains from Central India southwards, bearing large oblong leaves and large white flowers in short terminal spikes, which appear from April to May. In a climate with abundant rain during the monsoon season and moderate altitude, this tree is highly ornamental.

¹ *Myrtaceæ*, from the genus *myrtus*, from *myron*, perfume.

² *Bertholletia*, in honour of Louis Claude Berthollet, a celebrated French chemist; *excelsa*, high.

COUROUPITA GUINENSIS—*the Cannon-ball Tree*.—A tree of tropical South America, bearing a large sub-globular, hard-shelled fruit, which suggests the name. It bears alternate, entire leaves and large racemes of flowers descending from the stem, and large branches. It thrives in the moist hot climate of Pondicherry.

EUCALYPTUS CITRIODORA may easily be raised from seed, and forms a handsome young tree with a pleasant lemon odour from its leaves. Its life at sea-level is short, but from 4,000 feet upwards, it promises to become a useful tree.

EUCALYPTUS GLOBULUS has often been tried in the plains, but no success can be recorded at a lower altitude than 5,000 feet. At Poona, it grows rapidly for two or three years, but apparently does not get the necessary periodical rest, and dies within five years.

EUCALYPTUS VIMINALIS is the hardiest of the genus in the plains. At Poona, it grows to a very tall straight tree, with very slender stem, having deeply-cracked bark and alternate leaves formed like a curved sword, and gives white flowers, the size of a four-anna piece, in November.

EUGENIA MALACCAENSIS—*Malay-ka-jam*.—A small tree thriving in hot moist districts, and having ovate-lanceolate, smooth, leathery, opposite leaves, 9 to 12 by $3\frac{1}{2}$ inches, and dense racemes of crimson flowers, with four glandular petals and numerous stamens. Propagated by seed.

EUGENIA MICHELII—*the Brazil Cherry*.—A pretty shrub resembling a large-leaved myrtle, and bearing small white flowers succeeded by fruit, about 1 by $\frac{3}{4}$ inches, resembling the Turk's-cap gourd in form, at first white, later scarlet, and ultimately yellow.

The JAMBUL TREE—*Eugenia jambolanum, Jambudo, Jámun, Kálájam, Jambú, Neredi, Nevale*.—This valuable tree thrives especially on good soil with under-

ground water within 10 feet from the surface. Therefore, it grows with the least possible attention on river banks, but it may be cultivated in the garden, with profit. The average seedling yields fruit of small size with little pulp, but throughout the country a few very superior sorts occur, which may easily be grafted to seedling plants by the whip graft, with the use of the graft protector, during August and September. The seed has several embryos. The fruit has a valuable reputation in diabetes, which scientific investigation (*Pharma. Ind.*, II. 25) confirms.

THE ROSE APPLE—*Eugenia, jambos, Gulab-jamb, Jambos*.—A small tree, with opposite, lanceolate, short-stalked leaves and large flowers, having a great number of long white stamens, succeeded by a sub-globular berry as large as a guava, with rich pink and white colouring, but with little distinct flavour. It thrives especially in moist districts, and if branches of trees which yield especially fine fruit were grafted to seedling trees below ground-level, or actually on the root, the tree would be more widely valued.

GRIAS CAULIFLORA —*the Anchovy Pear*—is a showy tree having a straight stem crowned with a tuft of large leaves, and it bears its russet-brown drupes freely in Trinidad where the atmosphere is moist.

THE GUAVA—*Psidium guyava, Guava, Jam, Peyer, Peyeru, Amrul, Paral*.—A valuable fruit tree, yielding heavy crops of fruit that are widely appreciated, but are perhaps better utilised for the preparation of guava jelly, which has a world-wide market.

The guava is a smooth, thin-skinned fruit, varying from globular to pear-shaped, and in colour from yellowish-white to pale red, the pulp having a deeper tone of colour and a variable, but usually large number of seeds. Good examples of the fruit weigh 6½ ounces, but 8-ounce specimens are frequently seen, and the flavour is variable but always pleasant, and having little resemblance to any other flavour, is indescribable.

LAGERSTRÆMIA FLOS-REGINÆ¹—*Jarul, Taman, Mota-bhandara, Murutu*.—A very handsome tree, thriving in moist districts generally and in dry climates when planted on the bank of a tank. It has opposite, broadly-elliptic leaves, 4 to 9 inches in length, and large panicles of showy lilac flowers, 2½ inches in diameter.

LAGERSTRÆMIA PARVIFLORA²—*Naneh, Daura, Sida, Lendi*—is attractive from the abundance of small white fragrant flowers at the beginning of the rainy season. Its leaves are oblong, 2 to 3½ inches, leathery, greyish green, and with very short, if any, stalks.

NESÆA SALICIFOLIA³.—A small shrub, with opposite or alternate, very shortly-stalked, lanceolate pointed leaves, about 1½ inch, and small yellow flowers. It is common in Deccan gardens, and does not require special treatment. From Tropical America.

LAWSONIA ALBA⁴—*the Henna Plant, Mendee, Erkan, Gounta*—is a hardy shrub, suitable for fencing on a salty soil. Propagate by seeds or cuttings. In a rich soil, it may be cut down once a year with advantage, as it attains 5 feet in height, and bears its small, white, strongly-perfumed flowers at the end of the rainy season. "Odours of Paradise, flowers of the Henna," is a free translation of a characteristic street cry in Cairo. The prunings are worth about Rs. 5 per cartload for the preparation of henna, if near a city.

PUNICA GRANATUM⁵—*Pomegranate, Dalim, Anar*—enjoys a deep calcareous soil and thrives with less water than is required for the other members of this family.

¹ *Flos-reginæ*, flower of the queen.

² *Parviflora*, small flowered.

³ *Nesaea*, from *Nesos*, an island. It was found on the island of Mauritius. *Salicifolia*, willow-leaved.

⁴ *Lawsonia*, after Dr. Lawson, who published a *Voyage to Carolina*, in 1709; *alba*, white.

⁵ *Punica*, from *punicus*, Carthaginian; *granatum*, having seed or kernels.

The tree is usually raised from seed, but select varieties can be propagated easily by enarching. Pomegranate trees may be planted 8 feet apart and the ground cultivated with irrigated crops until the trees occupy the soil. Because pomegranate trees will live and bear some fruit with little attention, they are very often permitted to do so, while a good return for extra care may be relied on in the dry districts as well from this as any other fruit. A tree that bears fruit of good flavour with as few seeds as possible should be grafted on seedlings, and none but grafted plants grown. When the graft is made very low down, and the buds of the stock excised, or, when practicable, on pieces of the root, there are no shoots produced from the stock. Such trees need no more manure, water, or land than common seedlings, yet the value of their fruit is very great in comparison. A caterpillar infests the fruit, causing immense loss; the only prevention of it is to gather every fruit that is infested even to a slight degree and use for tanning leather. If the cultivators of a district will unite to do this for several years, the stock of that particular insect will be greatly reduced, and fair crops during some years may repay the trouble.

The following interesting account of this insect is quoted in the *Catalogue of Indian Lepidopterae*, in the British Museum: "The larvæ of this butterfly reside in the interior of the pomegranate; seven or eight at least having been reared in the interior of a small specimen of this fruit. Of the mode in which the eggs are deposited by the female in the interior of the pomegranate, no information has been received; it is, however, probable that this is effected whilst the fruit is in its very young state. The caterpillars feed upon the seeds and the inner part of the fruit, which is thus weakened, and rendered unable to support its own weight, and consequently liable to have its stem broken, and to fall to the ground with the first wind. This, however, would be destruction to the inclosed insects; since, in all probability, they would find it impossible to make their escape were the fruit to be suffered to lie rotting on the ground. To ob-

viate this evil, the caterpillars, when full fed, have the instinct to eat a hole about a quarter of an inch in diameter through the hard shell of the fruit whilst it remains on the tree; through this hole they then creep to the stem of the fruit, and spin a white web, which they attach to the basal part of the fruit as well as to the stem for about the distance of an inch along the latter. This web is sufficiently strong to support the pomegranate from falling after the wind has broken the stem near to the fruit."

WOODFORDIA FLORIBUNDI¹—*Dhauri, Dhayeti*.—A shrub producing slender drooping branches, bearing alternate shortly-stalked leaves which spread on two sides of the branches; the leaves are lance-shaped, green above and hoary below, the under surface with small black specks or soft hairs. The flowers are tubular, red, 1 inch in length, the stamens in some longer than the style, in others shorter, and are produced on short branches in profusion. It thrives in stony soil on hill-sides in Western India and in the outskirts of the garden. Is ornamental if planted on stony banks and watered occasionally during the monsoon. Propagated by cuttings and seed.

ONAGRACEÆ,² *The Fuchsia and Singara Family*, is a small group of herbs and shrubs, with alternate or opposite, usually entire, leaves, and with four brightly-coloured petals from the apex of the ovary. Abundant moving water is generally favourable. *Gunnera* and *Jussiaea* grow on the margin of, and *Shingara* in, pools; and *Clarkia*, *Godetia*, and *Oenothera* object to transplanting.

¹ *Woodfordia*, after J. Woodford, who wrote an account of the plants round Edinburgh. *Floribunda*, bearing many flowers.

² *Onagraceæ*, from *onagra*, an old name for the genus *œnothera*.

TRAPA BISPINOSA¹.—*Singara, Paniphal*.—The well-known singara nut or water chestnut with two or four spines; grows freely in tanks having a muddy bottom, and is very profitable when grown at a high altitude and near a market. It requires no special culture, and may be propagated by fresh seed or plants.

CLARKIA is a brilliant annual, growing nicely at 3,000 feet altitude and upwards. Its seed may be sown when the monsoon has abated somewhat, on the place it is required to flower, or thinly in pots, whence the plants may be set out without disturbing the roots.

GODETIA varieties are brilliant herbs, having rosy and crimson flowers produced in abundance. They may be raised by sowing thinly in pots under a rainshade during August-October, and planted out without disturbing the roots, when the monsoon has passed.

The trees in cultivation are generally raised from seed, and the fruit varies in quality greatly, but it is easy to graft branches of select trees to *roots* of the common sort, and by this means raise plantations all of one select sort. An unfounded impression prevails that by taking the pith out of the young tree, the fruit subsequently produced will be seedless (see "Horticultural Myths").

Good plantations occur from nearly sea level up to 3,000 feet altitude. The soil of the best plantations is a clay loam about two feet in depth, overlying *muram* or *kumkar* which provides thorough drainage. The trees are planted 10 to 12 feet apart, and an ordinary irrigated crop is grown on the interspace during the heavily manured first two years; then the trees having nearly occupied the ground, begin to bear. After this stage, at the end of the rainy season, the ground is thoroughly dug, the roots opened and manured, and the ground arranged for irrigation, and, after about six weeks of

¹ *Trapa*, abridged from *calcitrapa*, an instrument with spines, used to impede cavalry by injuring the horses' feet; *bispinosa*, having two spines.

The GUAVA with variegated leaves—*Psidium guava variegata*—is a showy shrub for the lawn on a moist, sandy soil, propagated by grafting on roots of the common guava.

MELALEUCA STRIATA,¹ from Australia, is a stiff, erect shrub with thick leathery, linear, pointed, alternate-sessile leaves, and spikes of bright-crimson crowded flowers, resembling a bottle brush with their numerous stamens. It is of extremely slow growth, but in fair loamy soil remains healthy, flowers freely, and needs little attention. It may be propagated by cuttings.

"It was not thus, in bowers of wanton ease,
Thy freedom nursed her sacred energies.
Oh, not beneath the enfeebling, withering glow
Of such dull luxury did these myrtles grow ;
. but in the bracing air
Of toil, of temperance, of that high, rare,
Ethereal virtue, which alone can breathe
Life, health, and lustre into Freedom's wreath."

¹ *Melaleuca*, from *melas*, black, *leukos*, white—the trunk of some species is black and the branches white; *striata*, striped.

PIMENTA OFFICINALIS.—A West Indian tree, bearing a berry about the size of a pea, having the odour of cinnamon, cloves, and nutmeg. It grows in a moist, equable climate, and with frequent watering during dry weather, thrives in any good soil.

MELASTOMACEÆ,¹ *the Pelori Family.*

MELASTOMA MALABATHRICUM²—*Pelori*.—It is remarkable that this shrub is rarely met with in Indian gardens, although it has large, showy, purple flowers, and grows freely in our jungles that have a moist climate. The seed does not germinate freely or bear transplanting, but if sown on a raised bed consisting of one-half stones and one-half earth, watered freely during the rainy season, and protected from hot winds, it will, no doubt, repay the trouble. Its flowers are bright purple, about 2 inches in expansion, and produced in copious terminal panicles.

MICONIA MAGNIFICA³—A grand foliage plant from Mexico, scarce in gardens, but thriving in a moist conservatory. The leaves are opposite, broadly-ovate, pointed, and attain 2½ feet by 12 inches, are of a rich, velvety deep-green, relieved by the ivory-white midrib and nerves curving from the base to the apex, the lower surface reddish purple, with prominent veins. Much heat and moisture, slight shade, a rich loamy soil, with perfect drainage and frequent watering with clear liquid manure during the growing season, from April till October, is required. Propagate by cuttings and “eyes” (single buds with a portion of stem), with bottom heat, and from seeds.

MICONIA BOWMANII⁴ has much smaller leaves, and is less showy and more hardy than the above. Its treatment is similar.

¹ *Melastomaceæ*, from the genus *melostoma*—*melis*, black, and *stoma*, a mouth, because the fruit of some species blackens the mouth.

² *Malabathricum*, from Malabar.

³ *Magnifica*, magnificent.

⁴ *Bowmanii*, Bowman's.

MEDINELLA TEYSINANNII (formerly *M. amabilis*) is a highly decorative conservatory plant suited for the warmest and most humid climates. It has square branches, opposite leaves, and terminal, pendulous flower-shoots of rosy-pink flowers, which remain a long time in perfection. It grows nicely in conservatories at Bombay, in a soil consisting of turfy loam, leaf-mould, and crushed shells.

LYTHRACEÆ,¹ *The Mindie and Pomegranate Family.*

Includes trees and shrubs having elegant blossoms, thriving without special care, and propagated by seeds or cuttings.

LAFcENSIA VANDELLIANA.—A shrub from Brazil, having opposite, entire leaves and large reddish-brown flowers. It thrives in Bombay gardens.

LAGERSTRÆMIA INDICA²—*Crêpe Myrtle, China-Mindie*.—A shrub with flowers from pure white to dark crimson, that bloom profusely early in the rainy season. Any good soil, with regular watering, is suitable. The popular name *Crêpe myrtle*, refers to the crisped state of the flowers and the resemblance to the myrtle. Propagate by cuttings. It thrives from 1,000 feet altitude up to the snow-line, and prefers a dry climate, although it grows naturally with “Sal” trees in the lower part of the Assam valley.

ÆNOTHERA ROSEA.³—A pretty annual from Mexico, 1 foot in height, with pink flowers of four obovate petals; is naturalised in Indian gardens.

¹ *v.*, from the genus *Lythrum*, from *lythron*, blood—it is said from the colour of the flowers.

² *Lagerstræmia*, in honour of Lagerstræm, of Gottenberg; *indica*, of India.

³ *Ænothra*, from *oinos*, wine, and *anthera*, a hunt or eager pursuit—an old Greek name given by Theophrastus to some plants, the roots of which were eaten to provoke a thirst for wine; *rosea*, rose-coloured.

THE EVENING PRIMROSE—*Oenothera Drummondii*.—A trailing plant, having large, bright, golden flowers, open in the evening. It may be raised from seed sown in August where the rainfall is under 40 inches, and in October where the rainfall is greater. It may be sown in pots very thinly and planted out without disturbing the roots, but should not be transplanted. 2,000 feet altitude or more is desirable in southern districts.

GODETIA and CLARKIA are very similar to the above in cultivation, and thrive in southern districts at 3,000 feet altitude, but lower towards the north.

FUCHSIA, of varieties, grow nicely from 4,000 feet altitude to 7,000, and plants brought to the plains and placed in a conservatory with moist atmosphere continue to blossom for a time, but, as they get no rest, dwindle away. The Fuchsia is propagated by cuttings of ripe wood planted in October, or of young shoots rooted on a hot bed in spring. A rich turfy loam, shade from bright sunshine, and frequent liquid manure during growing season, are necessary.

GUARA LINDHEIMERI is a graceful herb, annual in tropics, having alternate oblong leaves and terminal racemes of white or rosy flowers having the petals turned upward and the stamens downward. It grows nicely at 2,000 feet altitude. From Texas.

JUSSIÆA SUFFRUTICOSA¹—named *Panlavang*, or Water-clove, from the shape of its fruit—is an erect herb which thrives on the margin of a pond and is showy during the cold season, with numerous yellow flowers of four petals about $\frac{3}{4}$ -inch in expansion and with alternate lanceolate leaves.

¹ *Jussiaea*, in honour of a celebrated botanical family; *suffruticosa*, from *sub*, under, and *frutex*, a shrub—a less woody plant than a shrub.

PASSIFLOREÆ,¹ *The Passion Flowers.*

A group of plants chiefly of South American origin, well known in Indian gardens by the *papay*, *Carica papaya*, and Passion flower. For the cultivation of all this group a rich open soil, containing abundant lime and a liberal supply of water, is desirable, and a retentive black soil should be avoided. Propagation of the papay is generally by seed; the other members of the family are easily increased by cuttings and layers.

PASSIFLORA COCIMEA, has the flower scarlet, with orange rays, and the petiole bearing four to six glands, and blooms freely during August and September in dry districts.

PASSIFLORA EDULIS.² —An elegant climber. If planted at the foot of a wall with a cool aspect and the open rich soil noted above, its large three-lobed shining leaves and bluish-purple starlike flowers with two whorls of filamentous processes radiating from the centre, and a cherry-like perfume, and (on the hills) ovoid yellow fruit containing a refreshing juice, render it very attractive. At 2,000 feet altitude in latitude 18° N. it blooms throughout the rainy season, but rarely fruits; at 4,000 feet altitude it flowers and bears fruit abundantly. This species has two glands on the petiole near the base of the leaf and glandular serratures on the three bracts at the base of the flower.

PASSIFLORA LAURIFOLIA,³ with entire oblong leaves and large blue sweet-scented flowers; thrives with the treatment given above. In the West Indies this plant is valued for its fruit.

¹ *Passifloreæ*, from the genus *passiflora*, from *pator*, to suffer, and *flos*, a flower—given by the Jesuits from a resemblance to the passion of our Lord.

² *Edulis*, edible.

³ *Laurifolia*, having leaves like the laurel.

PASSIFLORA RADDIANA, has three-lobed leaves and bright red flowers produced in great abundance, one in the axil of each leaf, on long slender branches which hang gracefully when grown over an arch or on a tree. It enjoys the coolest exposure attainable in the plains of India or slight shade.

PASSIFLORA RACEMOSA,¹ has deep red or scarlet flowers, two in each axil, and usually four glands on the petiole of each leaf, and thrives with cool exposure or slight shade.

PASSIFLORA CÆRULEA and its white variety are suited for 4,000 to 7,000 feet altitude—several degrees of frost for a short time not doing it injury, and its beautiful flowers always satisfactory, good soil having abundant stones.

PASSIFLORA HOLOSERICEA² has soft downy leaves and flowers about 2 inches wide, spotted with red, purple, and white, and produced in great numbers during the cold season. An elegant climber for a northern aspect.

PASSIFLORA FÆTIDA³—*Ghani-vel*.—A small white passion-flower having soft hairy leaves, a foetid smell, and the bracts at the base of the fruit very much divided, giving the fruit a pleasing mossy appearance.

PASSIFLORA MURUCUIA.⁴—The bat-winged passion-flower, is useful for covering a conservatory wall. Its spreading lobed leaves form a neat covering, but in the plains it rarely blooms.

TACSONIA INSIGNIS.⁵—Closely resembles the passion-flowers in habit and culture, except that the calyx tube

¹ *Racemosa*, having long flowering branches, each flower being stalked.

² *Holosericea*, all over silky. ³ *Fætida*, having a disagreeable smell.

⁴ *Murucua*, an American vernacular name.

⁵ *Tacsonia*, from *tacso*, the Peruvian name of one of the species. *Insignis*, remarkable.

is longer and it will not bear as much heat. Between an altitude of 4,000 to 7,000 feet, it thrives and blooms freely in autumn. The plant may be distinguished by its violet crimson sepals with a green keel on the outside prolonged downwards into a spur one inch long.

CARICA PAPAYA¹—*The Papaw*.—This well-known tree has been subjected to ill-merited abuse, described as ugly and everything that is disagreeable, yet it may be questioned if there is a more handsome or generally useful tree in Indian gardens. If planted in a suitable position, its tall straight stem crowned by a grand tiara of large palmate leaves gracefully disposed on long stalks, the sweet perfume of the pendulous male flower or fruit borne by the female trees, useful in a green state as a cosmetic and when ripe a fair substitute for apples in a pie, surely are enough good qualities to deserve attention; but in addition we find the opinion of a correspondent in *Nature* that it deters mosquitos, and surely in the light of recent discoveries of the disease carrying propensities of those insects, nothing further is required to bring the graceful Papaya into favour. In North Queensland it is now regularly cultivated.

A loose rich soil with abundant lime and regular irrigation is desirable. The seed may be sown any time during the rains, a few seeds being put into holes 5 feet apart. If for ornamental purposes, the centre of a large group of shrubs is a suitable position—in this case the male tree should be preferred, as it produces numerous sweet-smelling flowers carried on long pendulous stalks. The first flowers appear when the plant is a few feet high, and a selection should be made at this time. If the plant is cultivated for fruit, one male to one hundred female trees is sufficient. The female flower is longer than the male, has a very short stalk, and the globular ovary.

¹ *Carica*, from Caria, erroneously supposed to be its native country. *Papaya*, from its vernacular name.

No 1 *Lagenaria vulgaris*, *Dhudia Kaddu* (ripe).
 " 2 " " (edible size)
 " 3 *Citrullus vulgaris fistulosa*, *Dilpasand* (ripe)

No 4 and 6 *Citrullus moschata*, *Kala bopala*
 " 5 *Cucurbita maxima* *Bopala*
 " 7 *Benicasia cerifera* *Kumbra*, *Pandree*
chicku



NOVEMBER GOURDS

No 8 *Cucumis momordica* *Furr kahri*
 " 9 *Luffa aegyptica*, *Ghiya Furoi*
 " 10 *Cucumis Madraspatensis*, *Mohia*

No 11 *Momordica charantia* *K. trolit*
 " 12 *Luffa acutangula*, *Furoi*

The Papay is largely grown at Poona and Bhownagar as follows: The ground is thoroughly ploughed and heavily manured during the hot season or beginning of the rainy season and prepared for irrigation. During July and August, Brinjal plants are set with lines of Papay, 5 feet apart, a few seeds being put into holes 3 feet apart in the lines, and thinned as necessary. The Brinjal crop is cleared off during the autumn, and about the same time the first flowers of the Papay appear, and declare the sex of the trees. As soon as this is determined, the male trees are mostly pulled up, a few being retained in corners to fertilise the flowers retained for seed.

The popular reputation of this fruit is given in the *Pharmacopœia of India* thus— "A belief in their powerful emmenagogue¹ properties prevails among all classes of women in Southern India; so much so, that they assert that if a pregnant woman partake of them, even in moderate quantities, abortion will be the probable result." Is this idea well founded?

MODECCA PALMATA - *Tyer-balli*.—A rare climber bearing globular hollow bright yellow fruit. Thrives in districts having a climate like its native country, North Kanara. Roxb. *Flora Ind.*, III., 135.

CUCURBITACEÆ, *The Gourd Tribe.*

"Those blossoms that have a kind of spindle in the centre are fruitful, the others not."— *Theophrastus*.

A family of climbing or creeping plants of great importance, from the numerous esculent fruits it affords (melon, cucumber, and others), and from a few important medicines (colocynth and elaterium). These plants have the sexes in separate flowers, and in many cases all the flowers of a particular plant are of one sex only.

¹ *Emmenagogue*, promoting the monthly discharge.

The cultivated members of this family are of very rapid growth, and in consequence require rich soil, abundant water, and manure in large quantities, especially liquid manure is of much importance. They are found to need specially nitrogen, 8.30 %; potassium, 11.30 %; phosphoric acid, 14.10 %—3½ ozs. per square yard. Propagation generally is effected by seed only, but the stem takes root freely, and cuttings may be used to propagate a few of the species, which live several years. Thoroughly ripened seeds retain vitality many years.

The value of hereditary influence in this family is remarkable. To grow melons and cucumbers of fine quality from seed grown in the country is easy, but to grow the varieties of those vegetables that are cultivated abroad requires great care. Those varieties appear to need a subdued light, and to be more subject to insect attacks than the country varieties. Raised banks of very rich friable soil, with means of watering abundantly, and the shelter of the *malla* are desirable.

“The cucumber family of plants is largely preyed upon by a twelve-spotted beetle like a ladybird, which, alike in the grub and the perfect state, feed on the leaves and flower-buds.” Balf. *Cyclo. Ind.*, “Insects.” Here is evidently a depredator living under false colours.

BENICASA¹ CERIFERA — *Petha*, *Kumhra*, *Pandree*, *Chickee* (No. 7 in illustration).—A cheap gourd much used in pickle and in the manufacture of sweetmeats. It averages 5 lbs. in weight, is oval or globular, regular in outline, has short stiff hairs, and is covered with a whitish bloom, which comes off freely on the hands, and is believed by mallees to permanently whiten the hair if applied to it. Grown during the rainy season on a trellis, as described under DILPASAND.

BRYONOPSIS LACINIOSA²—*Bryonia laciniosa*, *Sivalinga*, *Kavdodi*, *Nehoemeka*, *Gargu-naru*.—An orna-

¹ *Benicasa*, in memory of the Italian nobleman of that name.

² *Bryonopsis*, like *bryony*, from *bryo*, to sprout, in allusion to the rapid growth; *laciniosa*, having tassel-like appendages.

mental small gourd, produced at the end of the rainy season, when, long vines, bearing clusters of globular fruit, $\frac{3}{4}$ in. in diameter, red with white streaks, are common in hedges in the Deccan. As the fruit ripens, the leaves dry up. Alluvial soil and 30 inches of rainfall are suitable. Seed may be set during the rainy season.

CITRULLUS COLOCYNTHIS—the *Colocynth plant*, *Indrayan*, *Kuroo-Indrayan*. This medicinal plant is abundant on the loose sandy tracts of the coast of Guzerat, and in the Deccan on a loose open dry soil. On newly-formed railway embankments it yields heavy crops.

CHIBU— or *Chibbur*—a gourd weighing from 6 ozs. to $1\frac{1}{2}$ lbs., globular depressed, sometimes obscurely triangular, smooth, of a rich brown, marked by nine yellow irregular, often longitudinal, stripes and intermediate yellow spots. Interior flesh firm, pure white. Seeds very numerous, imbedded in a watery pulp. A circular scar $\frac{1}{8}$ inch diameter marks the insertion of the style. This gourd occurs in Bombay market during the cold season, price 1 anna for large size ; it is grown in Katia-wad, and appears to be a variety of *Cucumis momordica*, but I have not seen the plant.

CITRULLUS VULGARIS the *Water-melon*, *Kalingra*, *Kalinda*, *Tarbooza*.—The water-melon is most successfully cultivated on gravelly banks in the beds of rivers where the roots can reach water. It needs abundance of the richest manure, and the seed to be set from January to February. It may be grown in the garden by the method detailed for the melon.

CITRULLUS VULGARIS FISTULOSUS¹—*Dilpasand*, *Trindus*, *Tinda*, *Tensi*, *Denshi*.—In its edible stage, a globular smooth gourd, the size of the fist, having short, stiff hairs, and averaging 10 oz. in weight, sometimes

¹ *Citrullus*, from *citrus*, in allusion to the orange-like fruit ; *vulgaris*, common ; *fistulosus*, like a pipe, having a hollow stem.

with slight vertical ridges, and when ripe about 9 inches in width by 3 in depth, of a pure white, pale yellow, or red colour, without markings. This variety is cultivated generally in Gujerat and Sind, but is not common in other districts. It is sown in the hot season in *mulas*, and is in use until the rainy season is well advanced. No. 3 in illustration is a ripe fruit.

COCCINEA INDICA—*Tondli, Vimba, Tela Boocha, Kaydonda*.—A useful climber, ornamental on a rocky bank. It has a perennial rootstock, scabrid stems 3 inches diameter, dioecious white flowers, and oblong bright-scarlet edible fruit, 2 inches in length. Any ordinary garden soil and natural watering suit it.

*CUCUMIS MELO*¹—*the Melon, Kurboos*.—Of the many varieties of melons that are grown in this country, the best suffer greatly from any excessive moisture in the atmosphere, yet they enjoy a very large quantity of water at the root. Any rich, friable, loamy soil is suitable. It should be laid up in large ridges, between which the seed should be sown, and the plants trained over the ridges, so as to be perfectly secure from excess of moisture. The seed may be sown from September to December. When the plants have grown about a foot, the point of the shoot should be taken off, so that several other shoots may branch out; the points of these should also be taken off until there are about a dozen branches. These may be permitted to remain until one or two fruits have formed on each branch, then the point should be taken from the branches, and any fresh shoots that appear should be pinched out. Water should be given freely once in two days until the fruit is nearly ripe, when it should be discontinued. The melon, like others of its tribe (the cucumber, pumpkin, etc.), has the male and the female organs in separate flowers, and sometimes they are on separate plants.

¹ *Cucumis*, a cucumber; *melo*, a melon.

The varieties of melon grown in India are very numerous, and being freely cross-fertilised, do not come "true" to the character of the fruit from which the seed is taken, unless special attention be given to hand fertilisation over a series of years. Description of them would occupy more space than can be spared, but the *chitla* of Lucknow, may be noted, because Bonavia says it is rapidly deteriorating and needs the attention of all good cultivators. That gentleman describes it as: "*Chitla Karbooza*, a small globular fruit, flattened at the poles, with a green rind, marbled white; flesh white, somewhat granular or mealy, and of excellent flavour. Edible up to the rind."

The Sarda melon, which has been greatly extolled, is said to be the Cabul variety left on the vines during winter.

To grow a few choice melons or cucumbers. - During the early months of the year, place a large new *gurha* (unglazed earthenware water-vessel) in a hollow on a well-stirred sandy soil; cover the mouth, and pile around friable soil mixed with abundant manure. Set melon seeds around, and place a handful of saltpetre, or some nitrogenous substance, in the *gurha*; fill with water and cover the mouth. During the first week or so it may be necessary to water the seed until it has started into growth and its roots have reached the sides of the *gurha*; afterwards, filling the pot when dry will be sufficient.

Signs of ripeness in melons vary with the variety, but generally the rich perfume and the soft feel are sufficient indications; but some are over-ripe before these symptoms appear. In such cases, the cracked foot-stalk, or a soft ring near to the stalk, are the indications of value. It is amusing to watch a fruit-dealer selling melons. There are two systems: in one, the buyer chooses the fruit and takes the risk of its being unripe, and in the other, for an extra price, the seller guarantees the fruit to be ripe. In the latter case, he selects a fruit from his

store and ostentatiously taps it with his finger-nail all over, quietly testing it at the ring near the stalk, in the midst of his humbug; then, taking up his knife, he boldly cuts out a bit, and displays the colour and perfume peculiar to a ripe fruit of the particular variety.

CUCUMIS MOMORDICA—*the Splitting Cucumber, Turr-Kakri, Funt, Tuti, Pedda-dorsay*.—A pale-green, brown, or white, smooth gourd, about 15 inches by 8, flattened in cross-section, hollow, and with white flesh, very good to eat raw with sugar, and splitting slowly when ripe. Seed and plant like common cucumber. It is sown near the end of the rainy season, and comes into use during January and February.

CUCUMIS SATIVUS—*the Cucumber, Khira, Kakri, Dosray*.—We are fortunate in India in having this vegetable, which is easy to cultivate, and by using the local varieties adapted to the seasons, can be had in perfection during eight months of the year in districts where the rainfall does not exceed 40 inches annually. Any rich garden soil is suitable. During the dry season, arrange for irrigation, and during the rainy season, sow on raised banks, so that there may be no stagnant water. If a few seeds are put in once in 15 days, from April till November, a steady supply may be expected.

CUCUMIS MELO AGRESTIS—*Mokia* (No. 10 in illustration).—A small egg-shaped gourd, averaging $1\frac{1}{2}$ by $\frac{3}{4}$ inch, used in pickling; is brought to market in considerable quantities in the Deccan during the three latter months of the year. It is not much cultivated, being abundant in hilly districts.

GREAT GOURD—*Cucurbita maxima, Bhopala*.—To grow monster specimens of Great Gourd:—Let the soil be open, friable, and not exhausted by recent cropping, and abundant water available for irrigation. The soil being marked off in circles about 6 feet radius, should be dressed with 6 inches in depth and dug 12 inches, the manure being mixed thoroughly with the soil, then

another circle of 4 feet radius being marked from the same centre, the soil on the outer 2 feet is thrown inward to deepen the mass of soil and form a trench into which irrigation water may be directed. About the middle of the rainy season, a dozen seeds may be planted $1\frac{1}{2}$ inches deep, near the centre of the "hill." The plants that appear need to be thinned out gradually until only two remain. Water is required in increasing quantity as the plant develops, and the surrounding trench may be filled at three days' interval. The earliest flowers may be pinched off and the two sexes observed - the male has yellow pollen and the female has the swollen rudimentary fruit at the base. Insects usually carry the pollen to the female flower, but it may be necessary to do so with a feather, shaking it over the centre abundantly. When fruit has been formed, if extra large specimens be required, only one to each plant should be retained, and watering with clear liquid manure should be continued and the points of extending shoots pinched out. Dry grass underneath the fruit and a shade over it induce rapid distention.

CUCURBITA PEPO OVIFERA¹—*Vegetable Marrow*.—This gourd is of easy culture in the Deccan during the rainy season, and in southern districts having a heavy rainfall during the cold season, but is not extensively grown, because *dhudia* serves nearly the same purpose. From the middle to the end of the rainy season, according as the rainfall is light or heavy, is the sowing time, and a sandy soil with abundant manure and heavy watering is desirable.

CUCURBITA MOSCHATA—*Kala-bhopala* (Nos. 4 and 6 in illustration).—A large gourd, variable in form, with an angular and furrowed peduncle carried on a creeping stem, bearing leaves with stiff hairs and usually white blotches. Its cultivation is the same as detailed above for *Cucurbita maxima*.

¹ *Ovifera*, egg-bearing, from the appearance of the fruit.

LAGENARIA VULGARIS¹—*Dhudia, Kaddu, Lauki* (Nos. 1, 2, and 3 in illustration).—This fine gourd is of easy culture and remains in season a long time. It may be sown at intervals of a month from February till August on a sandy soil heavily manured and watered, the seeds being planted in patches 6 feet apart, the creeping stems soon cover the ground. Ripe fruit of this sort, 20 lbs. in weight, are common. For the table it should be cut very young and cooked with milk sauce. It assumes a remarkable variety of shapes, and the woody ripened gourd is used for many domestic purposes.

LUFFA ÆGYPTICA—*Ghiya Taroi* (No. 9 in illustration).—An oblong fruit thickening at the lower end and without ridges, is highly ornamental as a climber, having bright golden flowers 3 inches wide, and fruit which in a young state is a very superior vegetable, and when thoroughly ripened, it forms the “loofah” of shops, an efficient bath-scrub. The seed is planted during the rainy season, and a support provided for it to run upon. The best loofahs are obtained in a cool climate.

LUFFA ACUTANGULA—*Turoi, Taroi, Katitaroi* (No. 12 in illustration).—An oblong fruit thickening at the lower end and having ten acute ridges; this and the preceding are both delightful vegetables when properly cooked, and are in season during three to four months at the end of the rainy season. Sowing during June–August on a rich soil, thoroughly watered and slightly shaded, gives succulent produce with little fibre.

MOMORDICA CHARANTIA—*Karali, Karola, Balsam Pear*.—An oblong yellow gourd covered with smooth tubercles, and having the seed immersed in red pulp. This gourd is bitter, but is used in cookery, after soaking in salt water. There are rainy and hot season varieties. The Americans say an alcoholic extract of

¹ *Lagenaria*, from *lagena*, a bottle. *Vulgaris*, common.

the seeds is a sovereign remedy for cuts. It is cultivated as described for other species, the seed being sown during the rainy season.

MOMORDICA COCHINCHINENSIS—*Kakrul*.—A large climber having simple tendrils, and three- to five-lobed leaves on glandular stalks, and yellow foetid flowers, three of the petals with black spots, and two with yellow glands and deep orange pollen on the male plants. The female flower is similar, and the fruit red, oval, 4 to 6 inches long, and marked by raised lines. It is native in Kanara, and blooms in July and August.

SECHIAM EDULE¹—*Chocho*—is a perennial climber from Tropical America (*Chayotte*). In consistency and flavour the fruit differs slightly from vegetable marrow, and attains 3½ lbs. in weight. The roots are tuberous and edible.

TRICHOSANTHES ANGUINA²—*Pandol, Chiconda, Chachinda, the Snake-gourd*. A gourd attaining 3 feet in length, with a thickness of 3 inches; is cultivated as a rainy season crop, with an arrangement for training the plant on, as described under **DILPASAND**.

TRICHOSANTHES PALMATA³—*Mukal, Koundal, Kaka-palam, Lal-indrayan*.—A gourd of a bright red colour and the size of an orange, borne by a perennial climber with palmate leaves, having black glands on the stalk and at the base of the blade, and large, white, elegantly-fringed flowers. Common on the Western Ghats about the end of the rainy season, and used in medicine.

TELPHARIA OCCIDENTALIS, of West Africa, has a small fringed flower, white, with crimson at centre, succeeded by a large ten-ribbed fruit, having oily seeds in abundance.

¹ *Sechium*, said to be from *sekos*, a pen or fold—the fruit being sometimes used for fattening hogs in the West Indian Islands.—Nicholson's *Dictionary*. *Edule*, edible.

² *Trichosanthes*, *trix*, *trichos*, a hair, and *anthos*, a flower, in allusion to the long hairs of the corolla; *anguina*, snake-like.

³ *Palmata*, palm-shaped, referring to the leaves.

BEGONIACEÆ,¹ *The Begonia Family,*

Is a small group of very beautiful herbs which thrive well in a coir-matting or grass conservatory.

Large brilliant flowers and tuberous roots, this class requires a distinct season of rest; and the other has handsome foliage, and may be kept growing slowly during the dry season.

The tuberous rooted section is raised from seed or from imported tubers. The seed is very minute, and should be sown on a mixture of well decayed leaf mould and sand previously thoroughly watered; the seed on being sown should be covered with a layer of soil not thicker than ordinary writing paper, and if water is required before the seed has germinated, it should be given by immersing the pot in water. Sow in April in a moist atmosphere; if good, the seed germinates quickly; and when the plants are fit to be handled, pick out into shallow pots, and when two inches high, give a final shift singly into larger pots. By October the plants should be gradually dried off, and when thoroughly dried, laid aside in a cool shady place till next May, when re-potting is necessary. A thin conservatory at an altitude of 4,000 to 7,000 feet is necessary to raise seedlings.

The foliage varieties are easily propagated by dividing the rhizomes or by leaf-cuttings. The centre of the leaf, with about an inch of the stalk, is the part which makes the best plant; but any place where two large veins meet will strike root if kept in a moist frame with a very sandy soil.

Soil.—A mixture of leaf mould, sharp sand, and ordinary garden soil is suitable. The climate of Poona, of which details are given in the climate tables, with slight shade and regular watering, produces very fine foliage Begonias; for the tuberous section, several degrees cooler,

¹ *Begoniaceæ*, from the genus *Begonia*, named after M. Begon, a French patron of botany.

that is, the shade temperature which occurs from 4,000 to 7,000 feet altitude, is desirable. A list of species and varieties may be found in the catalogues of nurserymen.

BEGONIA DISCOLOUR-REX is a cross between the bulbous and the rex group, not going to rest as the bulbous do, therefore suitable for the Deccan and similar climates.

BEGONIA PEARCHII.—A small yellow-flowered velvety reddish-leaved evergreen species, which thrives in the conservatory at 2,000 feet altitude.

CACTACEÆ,¹ *The Cactus Family.*

Many of this family are highly ornamental, and should be cultivated in every garden. A soil consisting of decayed garden sweepings, manure, good loam, and broken bricks in equal parts suits them. The soil must be arranged so as to secure thorough drainage, as from April to November water may be given freely during dry weather; during the interval the plants should be at rest, and do not require water. In hot dry climates thin shade greatly improves the appearance of plants of this family. Many of the sorts of Cactus may be grafted together with facility.

CEREUS GRANDIFLORUS, **C. TRIANGULARIS**,² and **C. QUADRANGULARIS** are grand night blooming, leafless climbers, which are satisfactory if treated as above, and bloom at the beginning of the monsoon. The flowers, with a small slice of the stem being cut off and taken indoors shortly after sunset, the expansion will continue and the flowers be fully displayed during the evening.

CEREUS PERUVIANUS.—A columnar cactus attaining 20 feet in height with a diameter of about 8 inches, and

¹ *Cactaceæ*, from *kaktos*, a name used by Theophrastus to describe a spiny plant.

² *Cereus*, from *cereus*, pliant, in reference to the shoots of some species; *grandiflorus*, large-flowered; *triangularis*, three cornered.

having 6 to 8 angles about $1\frac{1}{2}$ inch in depth. On the younger parts, the angles are armed with brown spines $\frac{1}{8}$ to $\frac{1}{2}$ inch in length, in groups of seven with very little of the "wool," which is common in this genus, at the base. The flowers arise directly from the angles of the stem and open in the evening. *Calyx tube*, smooth, green, 6 inches in length, $\frac{1}{2}$ inch wide at base, 1 inch wide at mouth. *Sepals* increase in size inwardly from $\frac{1}{4}$ by $\frac{1}{4}$ inch to $\frac{1}{2}$ inch by 4 inches, in five series, thick, reddish, and recurved at the apex; the innermost, thin rosy, acute. *Petals* pure white, 3 inches by $\frac{1}{2}$, acute, ascending. *Stamens* a little shorter than the petals, very numerous. *Style* equals length of stamens, and the stigma has twelve rays $\frac{1}{2}$ inch in length. It flowers at the beginning of the monsoon.

CEREUS TRIANGULARIS has three-angled stems which climb on trees by means of roots.

EPIPHYLLUM TRUNCATUM.¹ —A small thornless cactus, with short flattened branches abruptly terminated, and bearing numerous richly-coloured flowers, from white to crimson, during the cold season. As this plant is of a trailing habit, it displays its flowers better when grafted on a stock having an upright habit, such as *Pereskia bleo*, or a short piece of *Cereus serpentinus* or *Cereus triangularis*. The graft is very easily effected by cutting the skin off the flat branch of *Epiphyllum* about an inch from one end and making a cleft in the stock, into which the cut portion may be inserted and fixed by a bandage, aided with a piece of cork if the place be in a hollow. The newly grafted plant should be kept in a moist conservatory until union has taken place. Some grafters use the Cactus thorns to fix the scion. There are many varieties of *Epiphyllum truncatum* in cultivation, which vary in colour and size of the flowers.

Plants of this family make first-rate cattle food; if

¹ *Epiphyllum*, from *epi*, upon, and *phyllon*, a leaf — flowers appear on flattened leaf-like plant branches; *truncatum*, lopped abruptly.

thorny, the thorns may be burned off, and the parts should be cut up. Cattle need to be taught to eat them. That they would be a resource in times of scarcity, there is no doubt whatever; in some countries they are regularly used.

OPUNTIA COCHINELLIFERA has upright growth; the articles 9 by 4 inch by $\frac{1}{2}$ inch, quite unarmed, and with crimson flowers.

OPUNTIA DECUMANA.¹—A nearly thornless species, which is much cultivated in Southern Europe for its fruit, an insipid egg-shaped mass of pulp. This plant has been in cultivation in various parts of India during many years. With a very rich soil on a rocky bottom, it flowers and forms fruit during April, but unless the rains are retarded the fruit does not ripen well.

This species has flat oval branches 18 by 9 inches, spineless or with short spines in groups of two or three, the longest attaining $\frac{1}{4}$ inch. The flowers are $1\frac{1}{2}$ to 2 inches in expansion, clear yellow when fresh, but soon becoming coppery, the petals are irregularly emarginate. At the flowering stage the young fruit is 2 inches in length by 1 inch at the widest part; it ultimately attains nearly twice this size, and is armed, especially towards the apex, with numerous delicate spines, the longest of which attains half an inch.

OPUNTIA DEJECTA has an erect stem, primary branches at right angles and secondary pendulous, the articles are 9 inch by $1\frac{1}{2}$ inch by $\frac{1}{4}$ inch thorns in pairs, longer $\frac{1}{4}$ inch, shorter $\frac{1}{4}$ inch. Corolla of five petals, bright crimson, $\frac{1}{4}$ inch by $\frac{1}{2}$ inch, with an eight-cleft green stigma. The remarkable form of growth of this plant makes it interesting, and it thrives at 2,000 feet altitude on a sandy soil, watered occasionally, and with light rainfall.

¹ *Opuntia*, the old Latin name used by Pliny, and said to be from the city of Opus. *Decumana*, of a large size.

OPUNTIA DILLENII—*Nag-phuni*, *Naga-kali*.—The common prickly-pear of the Salem and Coimbatore districts, is very much admired for its large clear primrose flowers when it is seen in districts where it is less common, and it does not propagate itself in dry districts at an alarming rate, as *Opuntia nigricans*, the common prickly-pear of the Deccan does, and therefore it is preferable as a fence plant from South America.

OPUNTIA NIGRICANS—the common *Prickly Pear*—is more often in dry climates superabundant, but it may be removed easily by tearing up from the root and drying in a heap, the outer plants being thrown towards the centre by going round the heap once weekly. During wet weather it causes a smell, but the decomposition passes quickly, and a little fire removes the thorns.

PHYLLOCACTUS ACKERMANNI¹ has rich crimson flowers, 6 to 8 inches in diameter. P. CRENATUS² has creamy white flowers. P. ANGULIGER has white petals and orange or yellow sepals. The flowers open during the day and have a powerful fragrance. There are several other species and many hybrid forms in cultivation.

PHYLLOCACTUS HOOKERI⁴ is a very satisfactory garden cactus, with flat crenate branches about 2 feet long growing in tufts, and bearing during the early part of the rainy season white sweet-smelling flowers 6 inches in diameter, which open during the evening and close next morning. The flower may be cut during the afternoon with a small portion of the stem, taken in-doors and placed in water. To grow this cactus, plant cuttings on a bank of rich soil mixed with broken bricks, water freely, and afford thin shade.

¹ *Phyllocactus*—*Phyllon*, a leaf, and *cactus*, in allusion to the leaf-like stems. *Ackermanni*, Ackermann's.

² *Crenatus*, having notches.

³ *Anguliger*, snake-bearing, in reference to the snake-like branches.

⁴ *Hookeri*, after Sir W. Hooker, an eminent botanist.

FICOIDEÆ, *The Noon Flowers.*

A small group of herbs, often with succulent leaves, and adapted for culture in sandy soil without transplanting.

MESEMBRYANTHEMUM CRYSTALLINUM—*the Ice Plant*—which grows naturally on the sands near Alexandria, is easily cultivated on a sandy soil if sown at the end of the rainy season.

Several species of this genus, the Noon Flowers, from South Africa may be easily cultivated as above, but the rainy season usually cuts them off.

TETRAGONIA EXSPANSA—*New Zealand Spinach*.—A creeping herb with succulent stems, small yellow solitary or twin flowers on short pedicles, and triangular, succulent, obtuse, or acute leaves 2 or 3 inches in length on stalks as long as the blades, and four-angled fruit. If sown thinly near the end of the rainy season on a sandy soil freely watered, with protection from cold at night, in the northern districts, it yields a good supply of leaves fit for use as spinach. It is propagated from seed, which it yields in the Deccan.

UMBELLIFERÆ,¹ *The Carrot and Coriander Family.*

A very large and important family, easily distinguished by its umbrella-like inflorescence, consisting of many rays spreading from one point and bearing very small white or yellow flowers, the Umbel. Among garden examples, the Carrot, Celery, and Parsley are common, and the aromatic seeds, Coriander (*Coriandrum sativum*), Dill (*Peucedanum graveolens*) are well known. The members of this order thrive in deep, gravelly, rich soil, with a free supply of water during the growing season. Propagation chiefly by seed.

¹ *Umbellifera*, from *umbello*, a sunshade, and *fero*, I bear, from the form of the inflorescence.

The CARROT—*Daucus carota*,¹ *Gajir*.—The carrot may be grown in the Deccan and like districts, where the rainfall is not more than 25 inches annually during the rainy season, as a culinary vegetable, but the best flavoured roots are procured from sowings made during the cold season. It is better to have the ground for



CARROT (SUTTON'S FAVOURITE)

(By favour of Messrs Sutton & Co., Reading.)

carrots manured the year previous and well turned up some time before sowing. The seed should be sown in lines 8 inches apart, and the young plants thinned out about 2 inches apart. During the rainy season occasional slight watering is required if the weather prove dry; but during the cold season water should be given once a week.

Large sowings for forage should be made in October and November, and, if late rains are favourable, good crops may be grown in the Deccan on a deep retentive

¹ *Daucus*, from *daukon*, Greek, a kind of wild carrot; *carota*, a carrot.

soil without irrigation. At Poona the price is sometimes as low as Rs. 8 per ton in January.

The Deccani carrot is a root of good flavour, but small and uncultivated looking, averaging 5 inches in length and 2½ inches in thickness at the top, suddenly reducing to the point and, while growing, buried to the crown. The seed is comparatively large and the leaves much less divided than garden sorts which occur in catalogues. (See carrot moth.)

CARUM COPTICUM¹—*Owa, Ajwain*, and

CARUM ROXBURGHIANUM² *Ujmud, Chanoo, Rhadooni*—may be grown on sandy soil with irrigation if sown at the end of the rainy season.

CELERY—*Apium graveolens*.—The leaf stalks of this plant being the edible portion, it should be grown rapidly, so that the fibre may not be developed, and light should be excluded to make the stalks white or red, according to the variety. In its natural condition the plant has hollow leaf stalks, but carefully selected seed gives solid stalks having little fibre. The original plant is found wild in ditches in some parts of England and at the base of North-West Himalaya. It is easily cultivated in this country, and very fine stalks can be grown; but it is very rarely to be seen in the markets in a condition fit for the table. A well-drained soil is of the first importance. It should be dug 18 inches deep, and a heavy coating of manure turned in. If the soil is of a good draining quality, trenches should be dug 12 inches deep, the same wide, and manure dug in at the bottom of the trenches.

¹ *Carum*, from Caria, where it grew; *copticum*, referring to the Copts—Christian descendants of the ancient Egyptians.

² *Roxburghianum*, in honour of W. Roxburgh, a famous botanist, who worked in India.

³ *Apium*, said to be from a Celtic word for water, referring to the natural habitat of the plant; *graveolens*, heavy smelling.

The seed may be sown between July and November—the earlier time for districts having light rainfall and the latter for heavy rainfall—in lines 6 inches apart, on a bed of rich friable soil, and when grown about 4 inches the seedlings should be transplanted into the bottom of the trenches. The young plants should be watered gently at first; but after the plants have begun to grow, water freely every three days, adding liquid manure at alternate waterings.

When the plants have grown about 18 inches high, fill up the trenches with soil as high as the base of the leaves; this will form trenches between the rows, and then the water should be turned into them. The object of filling up these trenches with soil is to blanch the leaf stalks to render them white and crisp.

If the situation be subject to heavy rainfall or the soil be retentive, it is better to dispense with trenches and put the young plants in beds, using drain pipes and straw to effect the blanching process. The essential part is to keep out the light.

CELERIAC, or *Turnip-rooted Celery*, is a variety specially adapted for flavouring, but is not required in this country, because in a plantation of the typical sort many plants are to be found that are not fit for any other purpose.

CHERVIL—*Anthriscus cerefolium*, *Atrilal*.—If sown sparsely during August-October on rich friable soil on the northern side of a wall and thinned sufficiently, this aromatic herb grows nicely. For its virtues, see *Pharma. Ind.*, II., 132.

CORIANDRUM SATIVUM¹—*Coriander*; *the seed Dhunya*; *the herb Khotmir*.—An herb in general use, and easily grown in districts having slight rainfall from July to March, in other districts during the early part of the cold

¹*Coriandrum*, from *koris*, a bug, in allusion to the smell of the herb; *sativa*, sown or planted.

season it is abundant. The fruit, called Coriander seed, is a widely known condiment.

CUMINUM CYMINUM¹—*Cummin seed, Jira.*

FENNEL—*Foeniculum vulgare*,² *Bari-saunf, Panmohuri, Wariári, Bari-shop, Somp, Soppu*.—An aromatic pot herb with much divided leaves, the ultimate divisions linear, and yellow flowers. The seeds are largely grown in the Deccan as cold season crops. Sown in September-October on thoroughly stirred up soil and thinned if necessary, but not transplanted: or a few waterings may be necessary should the weather remain dry. As a pot herb in the dry districts it may be sown monthly from May till January, and under heavy rainfall from October till hot weather.

FŒNICULUM VULGARE --*Common Fennel, Panmuohri, Burra-sof.*

HYDROCOTYLE ASIATICA³—*Bhrumhi, Lhul-kara, Codagen*. --A little plant creeping on the surface where the soil is moist and slightly shaded and bearing orbicular or kidney-shaped leaves, 1½ to 2½ inches in longest diameter, and obscure flowers in groups of three to six. The medicinal virtues of *brumhi* are given in the *Pharm. Ind.* as “useful in constitutional syphilis, non-specific ulcerations, and in skin diseases; is valuable both as an internal and a local remedy.”

HYDROCOTYLE ROTUNDIFOLIA.⁴—A pretty little creeping plant of dense growth and covering the surface of flower pots that are regularly watered with a fresh green mantle. It is not beneficial to the principal subject in the pot, because it prevents the stirring of the soil

¹ *Cuminum, cyminum*, the Latin and Greek forms of the name of the cummin seed plant.

² *Foeniculum*, the Latin name of the fennel plant; *vulgare*, common,

³ *Hydrocotyle*, *hydro*, water, and *kotyle*, a vessel, in allusion to the form of the leaves of some species; *Asiatica*, from Asia.

⁴ *Rotundifolia*, having round leaves.

that is necessary for the healthy growth of many plants, but when grown in small shallow pots by itself it is very charming. Regular and frequent slight watering and shade from direct noonday sunshine are the conditions it enjoys. Propagation by division.

MEUM¹ ATHAMANTICUM—*Baldmoney*.—A small *Umbelliferous* plant attaining 15 inches in height and having minute white flowers in compound terminal umbels and leaves much divided into thread-like segments. This delicate little plant from the mountain pastures of Wales and Scotland thrives at Poona in a conservatory, with regular watering. A morsel of its stock chewed gives a persistent odour of parsnip to the breath. It is propagated by division and seed.

PARSLEY—*Caram sativum*.—This fine-flavoured herb can be grown to perfection in a great part of India; it requires a free sandy soil, and watering once a week when established. If the rainfall is over 50 inches annually, the beds should be raised so that the water may run off freely. It is advisable to sow parsley where it is wanted to remain.

PARSNIP—*Peucedanum sativum*.—This root can be grown easily in districts where the rainfall does not exceed 30 inches, as occurs in the Deccan, by sowing in deeply worked rich soil in July-August, and irrigating when the surface becomes dry. Transplanting is apt to make the root forked and injure it for culinary purposes.

PEUCEDANUM² GRANDE—*Báphuli Dúkú*.—An ornamental herb of the Western Ghats, suitable for filling flower beds in wet districts during the rainy season. It may be sown very thinly in pots during April-May and planted in vacant spaces before the monsoon sets in, thereby protecting the soil from washing from heavy rain and conserving soluble nitrogen.

¹ *Meum*—Meon, the old Greek name.

² *Peucedanum*, from *peuce*, a pine tree, and *danos*, a gift, on account of the resinous substance which exudes from some species.

ARALIACEÆ, *The Ivy Family*,

Is a small group of shrubs or climbing plants—woody Umbellifers—cultivated for their ornamental foliage, and having valuable medicinal properties.

A compost of good loam, broken bricks, and leaf-mould in equal parts, with abundant water from March to October, and in the interval a distinct season of rest, not permitting the plants to become dust-dry, but giving water at intervals of a week or so if the plants are growing in the ground, and if in pots, enough to keep the soil barely moist. Slight shade improves all the group. It is easy to engraft together several of the species, but no improvement is effected by the operation, except that by grafting new varieties on roots of the old sorts vigorous growth is produced and the stock of plants increased rapidly.

ARALIA BALFOURII (from New Caledonia) is a very fine plant for table or house decoration, enjoying the moist air of the conservatory with 1,000 feet to 5,000 feet altitude.

ARALIA¹ CHABRIERI, pinnate, about 1 foot in length, deep green, with wavy crimson at the mid rib.

ARALIA GUILFOYLII—*Tap-mari*, the *Fever Killer*.—So called by Indian gardeners, who have discovered in this elegant shrub antifebrile properties, known to Rumphius, A.D. 1626–1693 (Dymock, *Phar. Ind.*, II., 162); is of upright growth, not bending towards the light, and bearing large pinnate leaves, with elliptical leaflets having a broad cream-coloured margin. A “sport,” or accidental variation, irregularly lobed and softly spinose on the margin, is named ARALIA MONSTROSA.

ARALIA LONGIPES² has the long narrow leaflets extending from a central point and undulate at the margin. It is an elegant pot plant for house decoration.

¹ *Aralia*, from the genus *aralia*—the meaning of this name is unknown.

² *Longipes*, long-stalked.

ARALIA VEITCHII.¹—A graceful plant, having leaves of about eleven narrow undulated leaflets which spread from the end of the slender leafstalk (digitate); the leaves are glossy green above and dark red beneath.

ARALIA VEITCHII GRACILLIMA has radiating leaflets about $\frac{1}{4}$ inch in width and 6 to 8 inches in length, with an ivory-white central rib.

Casual forms of *Aralia* are abundant under distinct names, and thrive, especially, as conservatory plants.

FATSIA PAPYRIFERA²—*the Rice Paper Plant*.—A handsome shrub with 5 to 7-lobed alternate downy leaves long stalks, and, when mature, a large panicle of small creamy flowers during the cold season. Rice paper used by artists is a thin slice from the pith. Propagated by offsets.

FATSIA JAPONICA.—A common window plant in temperate climates; resembles the above, but has smooth shining leaves; it thrives at 4,000 to 7,000 feet altitude with shade.

HEDERA HELIX—*Ivy*.—A variety of this plant, wanting the beautiful green of the Irish ivy, grows freely on the shady side of a house if regularly watered. Propagated by cuttings.

HEPTAPLEURUM VENULOSUM.—A very large climber, with a straight slender stem and striking bold palmate compound leaves, having elliptic entire leaflets on long foot stalks. It thrives with the treatment given under *ARALIACEÆ* if kept in the grass conservatory or the northern side of a tree in dry districts or fully exposed in moist districts.

PANAX FRUTICOSUM.³—An elegant shrub with much divided leaves, of special use in dinner-table decoration;

¹ *Veitchii*, after Veitch, a well-known nurseryman.

² *Fatsia*, derived from the Japanese name of one of the species; *papyrifera*, producing paper.

³ *Panax*, from *pan*, all, and *akos*, a remedy, in allusion to the supposed medicinal properties of one of the species; *fruticosum*, shrubby.

has developed varieties named :—*P. DUMOSUM*,¹ with the leaf stalks olive green, mottled with light green; *P. PLUMATUM*,² with crispy narrow divisions of the leaf; *P. VICTORIÆ*,³ with ternate leaflets margined with white; *P. DISSECTUM*,⁴ with the leaflets having long marginal teeth; *P. DIFFISSUM*,⁵ with the marginal teeth turned upward; *P. LACINIATUM*; *P. COCHLEATUM*,⁶ has large oyster shell-like leaves; and *P. NITIDUM*⁷ is dwarf, and of neat habit, with ternate leaflets.

PANAX MASTERSIANUM.—A highly ornamental shrub from Borneo, has leaves attaining 3 feet in length, simply pinnate for the first half, thence the midrib divides into two branches; all the pinnules are lanceolate, toothed, and the leaves have the shining green surface usual in the genus.

TREVESIA PALMATA.—A small tree from the moist valleys of Chittagong, has a short erect spinose stem bearing alternate very large nearly circular leaves deeply once or twice lobed, and carried on long spiny stalks; the flowers are small, whitish, and produced in terminal panicles, and are succeeded by globular fruit bearing a conical style and enclosing about seven seeds, $\frac{1}{2}$ inch in length. With the shade of trees, abundant water, and a rich loamy soil, this showy plant thrives at Poona and Calcutta, and may be propagated by seed and cuttings.

CORNACEÆ,⁸ *The Dog-wood Family.*

A small group of trees or shrubs chiefly inhabiting temperate regions. One member, *AUCUBA JAPONICA*, is a yellow spotted or green leaved Japanese shrub. At an altitude of 5,000 feet, in hot climates, with protection

¹ *Dumosum*, bushy.

² *Plumatum*, plumed.

³ *Victoriæ*, after Queen Victoria.

⁴ *Dissectum*, twice cut.

⁵ *Diffissum*, twice cleft.

⁶ *Cochleatum*, the leaves resemble the oyster shell.

⁷ *Nitidum*, neat.

⁸ *Cornaceæ*, from the genus *cornus*, the Latin name of the cornel tree.

from noonday sun, it grows fairly, but at lower altitudes, where it has to compete with Crotons, it is not much valued.

CAPRIFOLIACEÆ,¹ *The Honeysuckle Family,*

Are scandant shrub from temperate regions, having opposite entire leaves and fragrant flowers; they thrive from 2,000 to 7,000 feet altitude.

LONICERA² SEMPERVIRENS has flowers crimson outside and yellow within.

LONICERA LESCHENAUULTII,³ has soft hairy branches and leaves of a pale green colour, the leaves subtending the flowers $\frac{1}{2}$ to 1 inch in length and petioled. The flowers in short clusters, pale yellow, and sweetly perfumed.

LONICERA RETICULATA⁴—*the golden-veined Japanese Honeysuckle*.—A pretty little climber with golden veins in its opposite, elliptic, ovate, acute, nearly sessile leaves, 2×1 inch; thrives at an altitude of 4,000 feet in Southern India, and also at Lahore.

LAYCESTARIA FORMOSA (from Himalaya), bearing drooping, seated, white flowers, at 3,000 to 7,000 feet altitude. Propagated by cuttings.

RUBIACEÆ,⁵ *The Coffee Family.*

An important group of trees, shrubs, and herbs, including Cinchona, Ipecacuanha, Coffee, Madder, and other plants of economic importance, and a large number of ornamental plants. Many members of this family are

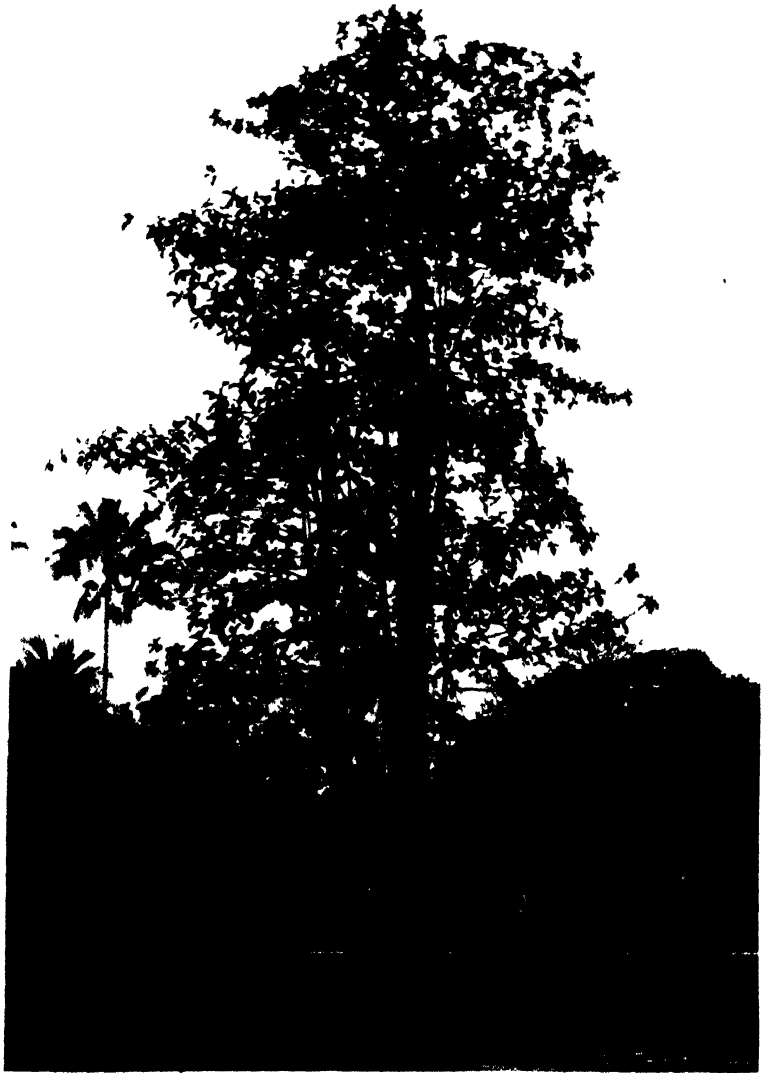
¹ *Caprifoliaceæ*, from the genus *caprifolium*, goat-leaf.

² *Lonicera*, after Lonicer, a German botanist.

³ *Leschenaultii*, after Leschenault, a French botanist, who travelled in India.

⁴ *Reticulata*, golden-netted.

⁵ *Rubiaceæ*, from the genus *rubia*, from *ruber*, red, in allusion to the dye which is extracted from the plant.



ANTHOCEPHALUS MACROPHYLLUS.

Facing page 843.

hard-wooded, and ordinary cuttings strike root without difficulty. In this class, layering or fresh seeds may be employed for propagating, or if shoots come from the base freely, as in some cases of *Gardenia*, cuttings of underground root-like stems may be used. The seeds as a rule retain the germinating power but a short time. The soft-wooded species strike root freely.

Soil.—For the hard-wooded kinds a good alluvial soil mixed with one-fourth part of broken potsherds, and for the soft-wooded the same mixture with one-fourth leaf mould added.

This family has several fine trees suitable for roadside planting in moist districts, including—

ADINA CORDIFOLIA—*Hedi, Hedu*.

ANTHOCEPHALUS MACROPHYLLUS (from Amboyna), in thirteen years attained a height of 50 feet in the Botanical Gardens, Calcutta.

ANTHOCEPHALUS INDICUS—*Kadam, Niv*.

MITRAGYNA PARVIFOLIA—*Kadam, Kalam*.

HYMENODYCTION EXCELSUM—*Kala-Kaddu, Bhorsal*.

HYMENODYCTION OBOVATUM—*Kadvá-sirid*.

CATESBÆA SPINOSA is an interesting thorny shrub, having white trumpet-shaped flowers. It grows nicely at Madras and Bombay, and blooms in the cold season.

COFFEE—*Bun*.—When free from the leaf disease—a fungus which has committed great havoc on coffee plantations—this valuable crop thrives at an altitude of 3,000 to 4,000 feet in Southern India, or a mean shade temperature of 63° to 70° Fahr., the lower temperature giving the heavier crops, and a northern slope, which will place the plants in shade during the afternoon, is found most productive. But the plant may be grown, with shade and irrigation, at a much lower altitude, and as the coffee tree is an elegant plant, either in its dark-green, glossy leaves, its pure white abundant flowers, or its load

of red berries, a few of them should be cultivated in every garden. The flowers have a heavy odour, disagreeable when very abundant. 1 lb. of coffee per tree was my result in an ordinary garden at Poonah—altitude 1,800 ft.

The soil desirable is an open, friable loam, rich in vegetable matter, and at least 3 feet in depth. The soil from which a forest has been cut is always preferable, but coffee may be produced on any good loam, not stiff clay or loose sand. Hillsides have usually been planted with coffee, but, if drainage be sufficient, level land is, if anything, preferable. The trees are reared from seed in selected berries, specially ripened on the tree, and only slightly dried, without removal of the pulp. It should be sown within a month or so of gathering, by placing a few inches apart in furrows 1 inch deep, on specially prepared beds of rich loose soil, and may be transplanted when one year old to pits prepared in lines, about 7 feet apart, and 6 feet from tree to tree. The culture required is frequent hoeing and keeping down weeds, keeping drains arranged to prevent scour or washing away of the friable soil, and at the same time to retain sufficient water for the tree. Manure, when available, is placed in a pit dug a few feet from the stem at a higher level. Cow-dung and decayed leaves are the manures most suitable, but dissolved bones, and fish guano that has been mixed with a considerable quantity of good soil, may both be applied with advantage at the rate of 2 cwts. per acre. Shade is desirable only when the mean temperature is high, and although it causes a delightful green colour in the foliage, it is generally considered, on the whole, to be detrimental. When necessary, the castor oil plant is a convenient means of obtaining protection from the sun.

Only common-sense pruning is necessary, that is, broken, decayed, or crowded branches should be removed, and the leader, or central shoot, stopped at the height a man's hand can reach, and any vertical shoots that compete with the main stem should be removed, and also any branches within 6 inches of the ground. Should the

position be exposed to strong wind, it may be desirable to keep the trees very low. Some plantations are as low as three feet. Pruning should, if possible, be done with a sharp knife, but, in intelligent hands, the *secateur* is an excellent instrument. When the crop is gathered, the berries may be soaked in water, then passed through a pulping machine, and again soaked 24 hours and stirred well to remove the pulp and floating beans, then dried on a barbique (a cemented floor exposed to the sun), with daily taking indoors, in case of rain or dew at night. This operation is laborious, and, recently, a drying-machine is much employed. After drying, the coffee bean is generally shelled, but a demand for coffee in the "parchment" is now met with, and for family use, it is waste of time to remove the shell.

*COFFEA ARABICA*¹ is the species most generally cultivated. *C. LIBERICA*² has larger leaves, and is adapted for the higher grades of temperature, therefore, lower altitudes. The Sierra Leone sort has leaves 3 by 2 inches, plane between the veins. Abeokutha coffee has leaves 10 by 4 inches, and needs a hot, moist climate. The Golden Drop variety of *Coffea arabica* is very fine. *C. STENOPHYLLA* has proved specially rich in caffeine. The results obtained by M. Bertrand of the Pasteur Institute, in an analysis of the species, are :—

<i>Coffea arabica</i> ,	-	0·83 ‰ to 1·60 ‰	caffeine.
„ <i>liberica</i> ,	-	1·06 ‰ to 1·45 ‰	„
„ <i>stenophylla</i> ,		1·52 ‰ to 1·70 ‰	„
„ <i>mauritiana</i> ,		·0 ‰	„
„ <i>humboldtii</i> ,		·0 ‰	„

The price obtained for coffee varies from 3½d. to 7d. per lb. delivered on the great markets, and is only profitable where labour is procurable at a low price. The cost

¹ *Coffea*, from Coffee, a province of Tarea, in Africa, where the common coffee grows in abundance; *arabica*, from Arabia.

² *Liberica*, from Liberia.

of production on the estate should not exceed half the price earned.

Coffee-leaf disease (Hemileia vastatrix) (Bark and Broom).—"First, pale circular patches appear on both sides of the leaf; later, deep orange patches of spores burst through the lower side of the leaf. Dilute Bordeaux mixture, or solution of potassium sulphide, used as a spray just before the usual time of the appearance of the disease, would be of value in preventing an epidemic."
—*Massee*.

GENIPI AMERICANA—*Genipap*.—A West Indian tree, with opposite, entire leaves with interpetiolar stipules, and bearing large cymose flowers having anthers prolonged into a lance-like end; succulent fruit, pale green in colour, but having a purplish juice with edible pulp. It is very near to *Randia* and *Gardenia*. It grows freely in moist air, and is propagated by seeds or cuttings.

GARDENIA GUMMIFERA.—A bush with resinous buds, and opposite, nearly sessile, oblong, pointed, shining leaves, 2 to 4 inches in length and widened towards the apex; flowers with very short stalks, pure white while fresh, and 3 inches diameter, succeeded by ellipsoid fruit 1 inch in length. This shrub thrives on a deep stony soil with occasional watering. It may be raised from seed or by layering. Plants from layers blossom the first season.

GARDENIA JASMINOIDES—formerly *G. florida*, *Gunduraja*.—The double-flowered variety of this neat shrub is much valued in the districts where it thrives, these being such as have heavy rainfall during a part of the year, or a moist atmosphere generally. *Jasminoides* is a compact shrub bearing opposite elliptic leaves, acute at both ends, and almost terminal, solitary, white flowers, 1 inch diameter, having a sweet perfume. At 4,000 feet altitude, its cultivation presents no difficulty.

GARDENIA THUNBERGII, of South Africa, has eight to ten divisions in its 5-inch pure white corolla, with a 4-inch tube.

HAMELIA PATENS, a South American undershrub, having bright red flowers in terminal cymes. Thrives with ordinary care, and is increased by cuttings.

HOFFMANNIA GHIESBREGHTII.¹—A handsome undershrub for the conservatory. It has a straight, four-angled, and winged stem, attaining 3 feet in height, opposite, broadly lanceolate, pointed, entire leaves with prominent veins, and of a dark velvety green above, and deep red beneath. A variety with white variegation and of more delicate growth is in cultivation. When the plant loses its lower leaves in the hot season, it should be cut down to within two inches from the soil. If the cuttings are placed in a moist shaded frame, young plants will be quickly obtained, and the old stock will shoot out again with vigour. Only one growth should be encouraged. Soil should be rich in leaf-mould and sand, and kept moist during the growing season.

IPECACUANHA.—This valuable medicine is the underground stem or “root” of *Cephaelis ipecacuanha*, a small undershrub from tropical South America. It has been found to grow fairly in districts with a humid atmosphere, and altitude from 1,000 to 3,000 feet, with close shade and soil rich in fallen leaves. It is propagated by dividing the underground stem, the growth is slow and the produce small in quantity, but of proportionate high value.

IXORA.

Ornamental shrubs having opposite entire smooth leaves with stipules between the leaf stalks and flowers in dense corymbs. Several are indigenous to India, and thrive in gardens, and one, **IXORA PARVIFLORA**, *Raikuda*, a small tree of the Western Ghats, useful in the

¹ *Hoffmannia*, after G. T. Hoffmann, professor of botany at Gottingen, 1862. (*Ghesbreghtii*, Ghesbreght's.

shrubby, has the property of burning freely when newly cut from the tree; a branch with green leaves may have the bark peeled off and set alight at once; it is named the torch tree. This remarkable property was shown to me by the headman of a village on the Ghats; it is necessary to remove the bark, and split up to wood somewhat, and within five minutes of being on the tree, it burns properly. I have since carried out the



IXORA.

process several times. *Ixora* thrive specially in moist districts, but with slight shade and irrigation can be grown successfully throughout India.

To induce the hybrid varieties of this genus to flower freely, a bed of sandy loam mixed with a liberal supply of old manure should be prepared in a position slightly shaded and with irrigation available, the upright-growing varieties being planted in the centre and the dwarf sorts towards the sides. *Gladiolus*, or other plants of similar habit may be planted between the *Ixoras* to enliven the bed until the principal occupants have grown up. The after treatment necessary is a yearly

dressing of fresh loam before the rainy season ; much manure is apt to induce growth more than flowers, and a thin screen to keep the sun off and enlarge the blooms during the flowering season, which includes December to February. Propagate by half ripened cuttings in sand under a frame and by seeds.

IXORA ACUMINATA.¹—A Himalayan shrub of upright habit with few branches. Flowers in cold season, pure white, fragrant, large, tube $1\frac{1}{2}$ inch in length ; leaves petiolate, broad, lanceolate, smooth.

*IXORA COCCINEA*² (Flame of the woods)—*Pat kuli, Bakora*.—Dwarf bushy habit, flowers bright red or yellow, and of every intermediate shade, in large heads, produced very freely from the end of the rainy season till the hot weather is well advanced ; leaves sessile, cordate, oblong, acute, shining. Abundant in the moist districts. In Calcutta this plant is used as an edging for wide roads with very satisfactory effect.

IXORA BHANDUCA is a variety of the above with scarlet flowers.

IXORA MACROTHYRSA.³—Other species of *Ixora* are so successful in our gardens in moist districts that the introduction of this grand species may be confidently looked for soon. It has bright red flowers produced in heads 8 inches in diameter, and in other respects closely resembles *Ixora acuminata*.

IXORA LANCEOLARIA.⁴—Flowers greenish white in terminal corymbs, leaves lanceolate, 9 by 1 inch, pallid, smooth, with nerves running parallel almost at right angle with the midrib.

¹ *Ixora*, meaning doubtful. *Accuminata*, having pointed leaves.

² *Coccinea*, scarlet.

³ *Macrothyrsa*, having a large, crowded inflorescence.

⁴ *Lanceolaria*, lance-leaved.

The following are garden varieties:—

IXORA AMBROSIA.—Orange salmon.

IXORA AURORA.—Orange-buff, changing to salmon.

IXORA BELLA.—Salmon-pink, shading to light salmon.

IXORA CHELSONI.—Orange-salmon, shaded pink.

IXORA CONCINNA.—Salmon, changing to salmon-pink.

IXORA DECORA.—Yellow, flaked with rosy crimson.

IXORA EMINENS.—Clear buff, changing to salmon-pink.

IXORA EXIMIA.—With long tubes, buff, changing to salmon-pink.

IXORA GEMMA.—Orange-yellow, in compact clusters.

IXORA ILLUSTRIS.—Bright orange-salmon.

IXORA INSIGNIS.—Rosy crimson, shaded orange.

IXORA MIRANDA.—Buff, changing to rosy-salmon.

IXORA ORNATA.—Orange-salmon.

IXORA PICTURATA.—Bright orange, changing to buff.

IXORA PROFUSA.—Soft rosy-salmon.

IXORA SPLENDIDA.—Orange-crimson.

IXORA VENUSTA.—Orange, changing to salmon-buff.

NITRAGYNE SPECIOSA is one of the plants credited with the suppression of the opium habit; possibly NITROGYNE PARVIFLORA—the *Kadam* or *Ralam*—may have the same property.

MOSSÆNDA FRONDOSA¹ and allied species are showy shrubs, having small white or orange-coloured flowers with one of the calyx lobes developed into a pure white leaf varying much in form and size. In Calcutta gardens these shrubs grow freely, and on the Western Ghats southwards and other moist districts are indigenous. Propagation is easily effected by cuttings and seeds.

¹ *Frondosa*, leafy.

PAVETTA INDICA¹—*Papat*.—A large shrub, valued for its elliptic, lanceolate, shortly petioled leaves with a distinct white midrib.

VIRECTA (PENTAS) CARNEA, a soft-wooded under-shrub having dense heads of carmine flowers, which are produced abundantly during the rainy season with ordinary treatment.

RANDIA UGLINOSA—*Pengar, Piralu, Pandri, Wagatta, Nella-kakisha*.—A small tree having a short stem and stiff divergent branches armed with strong thorns, and bearing a fascicle of opposite entire shining leaves 3 by 1½ inches, and sweet-smelling white flowers 3 to 4 inches in expansion, which appear at intervals almost throughout the year. The effect of this tree growing on the margin of a pond is singularly beautiful; it is a charming combination of the grotesque and the graceful. During the cold season, it ripens oval berries 2 inches in length containing numerous seeds, and is native in Guzerat and Northern Kanara.

RONDOLETIA ODORATA.—A hard-wooded Mexican shrub, having leaves in opposite remote pairs, ovate, acute, or acuminate, entire, waved, on very short petioles, and producing clusters of orange-crimson flowers. It grows slowly on a rich loam, shaded and watered occasionally. Cuttings of half-ripe wood taken during the cold season strike root under a glass frame if carefully watered, excess being fatal.

SERISSA FÆTIDA, a small shrub bearing small leaves, and suitable for a dwarf fence to separate internal divisions of a garden; the flowers are small, white, and attractive till crushed. It is easily increased by cuttings.

VANGUERIA EDULIS—*Voa vanga*.—A shrub from Madagascar, bearing a greenish-yellow fruit, succulent, edible, and resembling an apple. It is adapted for a moist climate, and is increased by seed from cuttings.

¹ *Pavetta*, the vernacular name of the plant in Malabar; *Indica*, from India.

DIPSACEÆ,¹ *The Teazel Family.*

This very small group of herbaceous plants include a few garden favourites.

SCABIOSA² MARITIMA, is in this climate an annual. If sown at the end of the rainy season, a fine show of bloom may be expected about January and February. Rocks, loose loam, and steady watering are necessary.

SCABIOSA OCHROLENCA, is of dwarf growth, large yellow flowers, and pinnatifid hairy leaves. At Baroda this forms a showy bedding plant during January in sandy soil regularly watered. It may be sown during September to December.

Truffant thinks the best manure for composital contains—

Sulphate of ammonia,	-	-	-	2'20 lb.
Superphosphate of lime,	-	-	-	4'40 „
Chlorate of potassium,	-	-	-	2'20 „
Sulphate of lime,	-	-	-	4'40 „
Sulphate of iron,	-	-	-	2'20 „

8 to 10 oz. per square yard.

COMPOSITÆ, *The Aster or Sunflower Family.*

A natural order chiefly of herbs, rarely shrubs, distinguished by the inflorescence commonly called the flower, consisting of numerous small flowers seated together, as may be seen on dissecting a Sunflower, *Shewunttee*, *Karala*, or Aster. The order includes many beautiful flowers and several valuable oil seeds, as Sunflower, *Helianthus annuus*; *Kurdee* or *Kosumba*,

¹ *Dipsacææ*, from the genus *dipsacus*, from *dipsao*, to thirst, probably in consequence of the connate leaves of *dipsacus*, holding water.

² *Scabiosa*, from *scabies*, the itch, which disease the common species is said to cure.

Safflower, *Carthamus tinctorius*; *Karala* or *Khorasanec*, *Guizotia abyssinica*; and several medicinal plants, as Chamomile and *Downa*.

For cultivation a well-tilled soil, enriched with leaf mould, and sufficient water to keep the soil moist during the growing season, is necessary, and lime and



SUTTON'S DWARF BOUQUET DOUBLE ASTER

phosphoric acid are largely taken up, therefore dissolved bones are a valuable manure for plants of this family.

Propagation is effected by seeds, division, or cuttings, and yearly transplanting to fresh soil desirable for perennial species.

ACHILLEA MILLEFOLIUM—*Yarrow*, *Milfoil*, *Biranjafif*.—Yarrow is a pretty herb with pectenate leaves, and white or crimson flowers; it is at home on Himalaya, and grows nicely from 2,000 feet altitude upward,

on a well-tilled soil slightly shaded, and watered occasionally. For medicinal effects, see *Pharm. Ind.*, II. 272.

AGERATUM MEXICANUM.—An herb having composite flowers varying from white to blue, useful as a bedding plant, thrives widely with little care, but the cultivated form imported, soon returns to the wild state, a white flowered weed.

ARTEMISIA ABROTANUM—*Southern Wood*.—Dedicated to St. Francis of Assisi—a kindly man who was good to everyone—is of easy culture in dry districts, and with precautions against stagnant water elsewhere. It thrives especially above 3,000 feet altitude, and may be increased by cuttings.

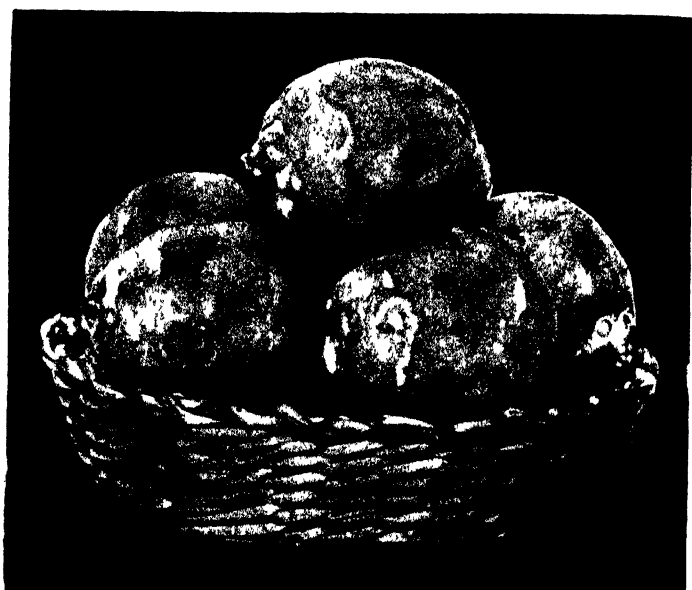
ARTEMISIA PALLENS—*Downa, Gundmar, Dona*.—With pinnatifid villous leaves is grown in large quantities at Allundie, near Poona, for use in Hindoo ceremonies. If a difficulty is found in obtaining seed, get plants in flower, place in a paper bag, and hang in shade.

ASTER AMELLUS.—A dwarf, perennial herb, suited for bedding purposes from its oblong, lanceolate, radical leaves of a greyish purple shade, and its very numerous heads of purple flowers produced in the cold season. In the dry districts this plant thrives with ordinary border treatment, and in Bombay may be flowered well by planting on a raised bank of soil.

BRACHYCOME IBERIDIFOLIA—*The Swan River Daisy*.—A pretty little daisy-like flower which thrives with ordinary border treatment, and may be raised from seed or cuttings.

CACALIA COCCINEA.—See *Senecio*.

GLOBE ARTICHOKE—*Cynara cardunculus, Kanjir, Kharshuf*.—This grand herb grows well in the dry districts, and is useful as an ornamental plant, but so few form the flower head that as a vegetable it is of no value, except when treated as the Cardoon by tying up the leaves to shut out the light and make the centre



WELL-GROWN JERUSALEM ARTICHOKES.

Facing page 355.

white and tender; but in the northern districts it is grown successfully, especially at an altitude from 2,000 to 7,000 feet, and in Afghanistan and Persia. The edible part is the receptacle at the base of the flower head, and for the quantity of food produced, is an expensive dish. Seed ripened in Northern India produces heads more freely than imported seed.

JERUSALEM ARTICHOKE—*Helianthus tuberosus*.—The tubers of this plant form a much appreciated vegetable, and its cultivation in districts with rainfall under 50 inches, presents so little difficulty that it should be more common. Any fair garden soil is suitable if well tilled and manured. Tubers may be planted about the time young shoots appear, this is generally some weeks before the monsoon is due; one foot apart in lines two feet apart is suitable, and water should be given freely until the monsoon sets in. Tubers will be fit for use after growth during ten weeks, and should be used when well developed, but before hardening. When the stems have dried up, a supply may be preserved for "seed" by covering the soil with six inches deep of dry leaves, and keeping the soil dry, but it is often advisable to lift the tubes and store in an unglazed earthenware pot (*gurha*), dry sand being run in to fill the interstices, and a cover arranged to exclude rats. The crop weighed at Poona was 5 lbs. per square yard, or practically 9 to 10 tons per acre.

ARCHOKIS GRANDIS.—A South African herb with composite flowers, the ray satiny white, yellow toward the base, and lilac on the under face, and a blue disk. Raise from seed, sown where required to bloom.

HELIANTHUS RIGIDUS.—A small form of sunflower having flower head 4 inches across; the ray florets bright golden, the disk florets dark chocolate colour. It may be sown from June onwards where the rainfall is less than 40 inches; where more rain falls, sowing should be deferred until the monsoon be nearly over.

ASTERS, GERMAN OR CHINESE.

CALISTEPHUS HORTENSIS (SELECTED)—Are favourite annuals adapted for dry districts during the rainy season, or districts with heavy rainfall after the monsoon is over. For sowing it is advisable to prepare a raised bed of friable rich soil, and sow thinly in lines four inches apart for transplanting when about 2 inches in height, the seed bed should be sheltered from hot sun, and carefully watered enough to keep the soil moist. July is a suitable season for sowing at Poona, or places of similar rainfall and altitude, and sowing may be repeated fortnightly if a succession of flowers be required; for Bombay and other places with a heavy monsoon and a hot October, sowing may begin in November, and be repeated at short intervals till January. When the plants are 2 inches in height, they may be transplanted to flowering quarters, and set 6 to 9 inches apart, according as the variety grows tall or dwarf.

CALENDULA OFFICINALIS¹—*Marigold*.—The Marigold grows in districts having a fairly dry atmosphere, with the least possible trouble, and is interesting from the mysterious flashes of light that it emits in darkness; the source of the light has not been satisfactorily explained.

CENTAUREA CYANUS²—*Blue-bottle*.—Sow in August with northern exposure; the flowers come during the cold season, then the plant dies as the heat comes on.

CHARIEIS HETEROPHYLLA.—A South African dwarf annual, having small flower heads, the ray florets blue, the disk yellow. It is of easy culture where tropical showers do not reach it, and may be sown from August to November.

¹ *Calendula*, from *calendæ*, the first day of the month, in allusion to the almost perpetual flowering; *officinalis*, sold in shops.

² *Centaurea*, from *kentaurion*, the name given by Dioscorides to the century, *Erythræa centaurium*; *cyanus*, dark blue.



SEEDLING PLANT OF SUTTON'S
LARGE-FLOWERING CHRYSANTHEMUM.

CHICORY—*Cichorium intibus*.—At altitudes from 2,000 to 6,000 feet in Southern districts and lower in Northern parts, good Chicory may be grown by sowing in lines 2 feet apart during August and keeping the soil moist and open till January. The plants need to be thinned out, but the best roots are produced without transplanting.

CHRYSANTHEMUM¹ INDICUM—*Shewunttee*, *Chamunti*, *Guldaudi*.—A few varieties of this popular flower are in cultivation on a large scale in market gardens for cut flowers, and occasionally plants of the finer varieties are to be met with, but rarely in the condition the plant is capable of. To grow the Chrysanthemum, prepare a large bed in a place exposed to the morning sun and with abundant light all day, but shaded from direct sunshine after noon. Enrich the soil with plenty of manure of the strongest sort available, work the soil thoroughly, and arrange for irrigation. After the flowering season, turn out the old plants and tear apart, plant short healthy pieces having a few roots about 1 foot apart, shade slightly for a few days, and when growth commences water freely; or take cuttings of the young offsets in August, and root in a frame. If the district be one with rainfall under 40 inches, prepare a fresh bed in a place more exposed to sunshine, yet sheltered from strong winds—a bed of standard roses 5 feet apart is suitable; transplant at the beginning of the rainy season, moving a good ball of earth with the plants, and put out 3 feet apart, or, if among other plants, at convenient distances; water freely with liquid manure, and stir the surface at short intervals. If the rainfall is heavy, it will be better to plant in large pots, which may rest on bricks, near the sheltered side of a wall, so that a great part of the rain may pass over them; and replant in the borders as soon as the rain is nearly over. The large-flowering sorts are most successful in Northern districts—Lahore produces them fairly—and a cool climate with protection from the

¹ *Chrysanthemum*, golden flower.

rays of the sun is necessary. When grown in pots, watering with liquid manure twice weekly is desirable; and to get the largest flowers, the terminal bud on each stem must be selected at a very early stage and all others removed. The small-flowering early sorts which begin to bloom in August need not be disbudded.

CINERARIAS—*Senecio cruentus*.—Originally from Teneriffe. May be grown easily by sowing during August to October at 4,000 to 6,000 feet altitude with abundant light yet protection from heavy rain, and separating the seedlings sufficient to prevent overcrowding. The soil should be good loam enriched with leaf mould and kept open with sand or crushed charcoal. Heavy rain often destroys the blossom, but in a conservatory at Wellington they may be produced successfully.

CINERARIA MARITIMA.—At an altitude of 3,000 to 7,000 feet, with a moist climate, this white bedding plant can easily be produced, but the monsoon rain is destructive.

CINERARIA STELLATA.—The Star Cineraria has an elegant open habit and bears much exposure.

COREOPSIS ARISTOSA.¹—Flowers yellow, large, and with the leaf divisions broad.

COREOPSIS DRUMMONDII.—Flowers maroon and yellow, a dwarf species, with broad leaf divisions. There are many other species and varieties; all are charming plants of easy culture.

COREOPSIS TINCTORIA.²—Flowers maroon and yellow, tall or dwarf, leaves pinnate, with linear segments. One of the most beautiful of our garden annuals, and also very easy to manage. If the rainfall be over 50 inches, it should be sown late. When planted among dwarf shrubs it is very fine.

¹ *Coreopsis, koris*, a bug, and *opsis*, like : referring to the appearance of the seed; *aristosa*, having sharp points.

² *Tinctoria*, coloured.

COSMOS BIPINNATUS.¹—An annual with twice pinnate leaves, having linear segments and rose or purple ray florets with a yellow disk; of easy culture if sown in August and protected from tropical showers.

CROSSOSTEPHIUM ARTEMISIOIDES.—A useful bedding plant, having small, alternate, much-divided greenish-grey leaves which contrast with *Alternanthera* and other dark-leaved plants. During the cold season it bears small heads of yellow flowers, which may be cut off. Propagation by cuttings in sandy soil steadily moist.

COLORADA RUBBER—*Hymoxys*, sp.—The root of this plant is said by Mr. Naylor to give 10 % of Rubber, and it would probably grow in dry districts.

THE DAHLIA.²—This showy flower has been divided into distinct classes, some of which are popular in dry districts like the Deccan, where there is not too much rain during the wet season. The double varieties form great globes of vivid colour, and the single-flowered varieties and the “Cactus” form are remarkable for profusion of bloom combined with brilliant colour.

For the cultivation of either sort a very rich soil is necessary, and dried fish will be found in some places a very convenient means of enriching the soil; cow dung may also be used in considerable quantity.

The double varieties are propagated in this country by dividing the root when it is showing growth in May. This must be done very carefully, taking pieces showing fresh buds with a small portion of the thick root attached. These should be potted and watered carefully until fresh roots are formed, then planted out or potted in very rich soil. The young shoots may also be rooted on a hot bed.

The single varieties are grown from seed, which should be sown during May to July; if good, it germinates in a few days. When two inches high the plants

¹ *Bipinnatus*, having two pinnæ.

² *Dahlia*, named in honour of Dr. Dahl, a Swedish botanist and pupil of Linnæus.

should be transplanted to beds of carefully prepared soil in a moist, shady place, and may be put in 4 to 5 inches apart. Here the plants remain until 6 inches high, when they should be transplanted to their final quarters. If a mass of flowers be required the plants should be put in 3 feet apart and a neat stake provided to support each plant. Bloom will begin from early sowings about the middle of August and by late sowings continue till December.

In the Himalaya, cuttings from the base root freely if planted out where wanted and shaded a few days.

DAISY, DOUBLE—*Bellis perennis*—grows nicely in a watered border at 7,000 feet altitude with shade from the sun after noon.

DAISY—*Swan-river Daisy*, *Brachycone iberidifolia*.—Blossoms well if sown during August to October on an open border at 4,000 feet altitude, and lower with shade.

ENDIVE—*Cichorium endivia*—is a wholesome salad, and is used by the French also as a boiled vegetable. Its treatment is similar to that detailed for Lettuce.

FLAVIERA CONTRAYERBA.¹—An annual from Chili, bearing yellow composite flowers, seated in the axil of opposite leaves. It has white wart-like markings on the leaves while young, and the plant is used to dye yellow in its own country. In the dry districts of India it becomes too plentiful, and overran Bijapur a few years ago.

GAZANIA SPLENDENS.—A showy herb, having spatulate leaves, white silky beneath, and flower heads 2 to 3 inches in diameter, with a bright yellow ray and maroon disk. It is of easy culture at from 3,000 to 7,000 feet altitude, where there is not excess of rain. Cuttings thrive in the plains during the cold season.

GAILLARDIA ARISTATA, G. PULCHELLA, G. LORENZIANA, and G. PICTA are heat-enduring herbs of easy culture.

¹ *Flaviera*, from *flavus*, yellow; *contrayerba*, vermifuge.

GERBERA JAMIESONI.—An ornamental herb from the Transvaal, with flowers resembling Michelmas Daisy, but orange-coloured and deeply lobed leaves 5 to 10 inches long by 2 to 3 inches broad.

GUIZOTIA ABYSSINICA¹—*Kala teel, Kharasnee*.—An important field crop, yielding oil-seed, and planted in the garden for its fine yellow flowers, which in Bombay are the first to light up the flower beds when the monsoon is over. Sow from July at intervals of ten days, and transplant as desired.

GYNURA AURANTIACA.—An ornamental foliage herb, with alternate leaves covered with soft, violet hair. It grows 3 feet in height, is easily propagated by cuttings and seed, and thrives on rich soil regularly watered. The flowers are yellow and appear in December, but the plant remains longer ornamental if the flowers are cut off early.

A. Gynura, probably *G. Ovalis*, is one of the plants credited with preventing the opium habit, its infusion being used. Possibly *Gynura Angulosa*, described in Cooke's *Flora of the Presidency of Bombay*, Vol. II., p. 49; or *Gynura Aurantica*.

HELIANTHUS² ARGYROPHYLLUS.—The Silvery Leaved Sunflower is a remarkably elegant plant, whether in flower or not, and of easy culture from seed in a rich soil freely watered. If sown during September to October, it thrives in dry climates.

HELIANTHUS ANNUUS³—Sunflower, *Suriachaphul*.—As a garden plant, the Sunflower needs only a rich soil and abundant water at the root without a saturated atmosphere, and may be raised on a seed bed and transplanted without difficulty.

HELIANTHUS MULTIFLORUS.—A very handsome small Sunflower, growing 2 to 3 feet in height, and thriving

¹ *Abyssinica*, from Abyssinia.

² *Helianthus*, the sunflower.

³ *Annus*, of one year.

well if sown after the heavy monsoon is over in wet districts or in June for dry districts.

HELICHRYSUM VESTITUM should thrive in some of the cool, dry parts of Northern India; at the Cape, it is grown largely in some districts for immortal wreaths.

HELICHRYSUM.—Annuals with golden or white “everlasting” flowers; grow with ordinary care from 1,000 feet altitude upwards. Sow during rainy and cold seasons.

HELIPTERUM MANGLESII.¹—A very showy “everlasting” flowered annual with nearly sessile breast-shaped leaves and very abundant flowers, white to deep pink scarious tracts. As a pot plant, sown in September-October and thinned out, it is very showy during the cold season.

HELIPTERUM ROSEUM—*Acroclium rosenm.*—A dwarf “everlasting” annual from South Australia, having small rosy flower heads. In dry districts it does well if sown from August to October where it is wanted to bloom.

“KAULFUSSIA”—*Charieis heterophylla*.—A South African annual, having long-stalked flower heads with a blue ray and yellow or crimson disk. Grows nicely from 1,800 feet altitude upward, if sown in autumn on a well-tilled border and kept moist.

INULA ROYLEUNA, from Himalaya, is an herb 2 to 3 feet, with yellow flowers 2½ inches in diameter.

LETTUCE—*Salit, Kahu, Khuss, Lactuca sativa*—is one of the plants that have been so long in cultivation that its native country is doubtful. In hot climates it can be grown to perfection. It is eaten after dressing with various mixtures of oil, vinegar, salt, etc., without cooking, and is the chief of the vegetables called salad. In districts with slight rainfall, seed should be sown fortnightly from the beginning of the rainy till the end of

¹ *Helipterum, helios*, the sun, *pteron*, a wing, referring to the *pappus*; *manglesii*, Mangles’.

the cold season. With heavy rainfall, the rainy season should be half over before sowing, and the early crops raised under shelter and planted out on elevated beds. When the young plants are fit to handle, they should be planted out 9 inches apart in a bed of very rich friable soil and watered slightly once a day in dry weather. If inclined to spread, tie the outer leaves together at the top. To be tender and crisp, Lettuce must be grown rapidly, and in hot weather should be shaded during the heat of the day.

To save seed, select the best developed plants during December and transplant to fresh soil. All inferior plants that have not grown fit for table should be rooted out and not allowed to flower.

There are two classes, "Cabbage" and "Cos." The Cabbage Lettuce have broad rounded leaves forming a low spreading head. The Cos Lettuce has more narrow and upright leaves.

New varieties are continually appearing, but the POONA BROWN COS, which was introduced at Poona many years ago, retains its reputation as a black-seeded Cos Lettuce of very high quality, tender and crisp, and of delicious flavour.

König gives the composition of Lettuce:—

Water,	-	-	-	-	94.33
Non-Nitrogenous extract,-	-	-	-	-	2.19
Nitrogenous matter,	-	-	-	-	1.41
Fat, -	-	-	-	-	0.31
Cellulose, -	-	-	-	-	0.73
Ash, -	-	-	-	-	1.03

LEPTOSYNE.—Varieties grow at 3,000 feet altitude with ordinary border treatment.

LIGULARIA KEMPFERI AUREO-MACULATA.—A dwarf plant with circular or heart-shaped stalked leaves having large irregular yellow, white, or rosy blotches, and bearing yellow flowers at the end of the rainy season. This Japanese plant grows fairly in moist conservatories in

districts where rainfall is not heavy ; but thrives at 3,000 to 7,000 feet altitude. It needs to be kept moist while growing, but long-continued heavy rain is detrimental. Its propagation is effected by division.

MATRICARIA EXIMEA.—If sown in September, with protection from heavy rain, this golden- or white-flowered annual may be brought into flower during December and January by the same treatment as is given to Asters.

MONTANOA BIPINNATIFIDA.—An elegant herb 8 feet in height, having opposite deeply lobed leaves attaining 14 inches by 14 inches on long stalks, and abundant “flowers” with yellow disk and white ray produced at the top of the stems. It is easily propagated by seed or cuttings, and blossoms in November and December.

RUDBECKIA BICOLOR.—A showy annual, composite, having orange-yellow flowers with brown centres. If sown during August to October from 2,000 to 6,000 feet altitude it blooms during the cold season.

SALSAFY—*Trogopogon porrifolius*.—From 2,000 feet altitude upwards, Salsafy may be sown in August in lines 1 foot apart on a rich friable soil and the plants thinned out as they develop ; at altitudes over 5,000 feet, the growth is continued in spring and the crop comes into use during summer ; and at low altitudes, the roots are ready during the cold season.

SCORZONERA—*Scorzonera hispanica*¹—is cultivated as detailed for Salsafy. May be grown in the Deccan on very deeply worked soil heavily manured and irrigated, if sown in July or August. Under a heavy rainfall the young plants will decay ; therefore, in wet districts sowing must be deferred.

¹ *Scorzonera*, from the old French *scorzon*, a serpent, in allusion to supposed effects against snake bites ; *hispanica*, from Spain.

SANVITALIA PROCUMBENS.—A small yellow composite, creeps on the ground, and is useful as an edging among pots.

SOLIDAGO CANADENSE.

SPILANTHES ACMELLA—*Akulkara*.—An interesting herb, producing dense flower heads resembling in form and size a pigeon's egg, yellow at the apex and chocolate lower. When chewed, the flower head produces intense action of the salivary glands.

SENECIO JACOBEA.—Hardy annuals with white, purple, or red flowers. It thrives at 5,000 feet altitude on the northern side of a house.

TAGETES ERECTA¹ - *African Marigold, Gendu*.—The *Gendu* is a plant of easiest culture, and interesting from the flashes of light emitted on hot evenings in August and September.

TAGETES PATULA²—*French Marigold, Machamul*.—The French Marigold has maroon stripes on its yellow florets, and the highly selected flowers, carefully cultivated, are very beautiful subjects, not sufficiently appreciated in warm climates. It, like the *Gendu*, gives flashes of light on hot, moist evenings.

TARAXACUM OFFICINALIS³—*Taraxacum, Patridawa, Dudhal, Baran Kánphul*.—This is chiefly grown for use in medicine, and its cultivation was during many years carried on successfully near Poona on a carefully-worked loamy soil manured with well-decayed village sweepings and arranged for irrigation. The seed may be sown in August in lines 6 inches apart—careful thinning, weeding, and regular watering is all that is necessary till January, when the seed should be collected for future

¹ *Erecta*, erect.

² *Patula*, spreading.

³ *Taraxacum*, from *tarasco*, to disturb, to alter, from its supposed effect on the blood; *officinalis*, sold in shops.

sowing and the plants dug up in February and March. A fair crop is 1,500 lbs. of fresh roots per acre, which yield about 18 per cent. of the medicinal extract.

TITHONIA TAGETIFLORA.—A large soft-wooded shrub, bearing alternate, divided leaves, and in October very numerous flowers resembling small Sunflowers. A rapid growing screen if on a rich soil watered freely. Propagated by cuttings. The plant is a source of honey for bees.

VITTADINIA AUSTRALIS.—A pretty perennial herb, with slender branches. When planted in garden beds, it forms low compact growth, studded with pretty white flowers resembling the Daisy. It is much used in Madras as a covering for graves.

XERANTHEMUM. (See *Helichrysum*.)

ZINNIA ELEGANS.¹—This annual is of the easiest culture, and makes too free in Deccan gardens, soon going back to the wild form, which is not very ornamental.

GOODENOVIÆÆ.²

Two seashore shrubs that are frequent occupants of the shrubbery are of this family, *Scaevola*³ *Koenigii* and *S. Lobelia*.⁴ Those shrubs have stout succulent branches, smooth green alternate exstipulate entire elliptic obtuse leaves, and spikes of white flowers resembling a *Lobelia* in shape, succeeded by sub-spherical fruit with a hard endocarp. Propagated by cuttings and grown in the shrubbery with occasional watering. The leaves are used as a vegetable in Scind, and thin slices of the pith are used in making artificial flowers.

¹ *Zinnia*, named after Zinn, a German botanist; *elegans*, elegant.

² *Goodenoviæ*, from the genus *Goodenia*, in honour of Dr. Samuel Goodenough, Bishop of Carlisle, 1743-1827.

³ *Scaevola*, *scæva*, the left hand, alluding to the form of the corolla.

⁴ *Lobelia*, having a flower shaped as in the genus *Lobelia*.

CAMPANULACEÆ,¹ *The Bell Flower Family.*

A family of herbs, valued for the beauty of its flowers, and propagated by seeds or cuttings; the latter require a bell glass or frame to strike root, and are not easily managed. Seed is to be preferred.

CAMPANULA MEDIA² and the other bell flowers are short-lived in the tropics, but may be flowered if sown during August to October and planted on a moist border, shaded from midday sun, but at 4,000 feet altitude it thrives if protected from excessive rain.

LOBELIA ERINUS.³—This pretty little blue-flowered South African plant may be sown during July to November, the former date for light rainfall, the latter for heavy. South of Bombay it grows nicely at 3,000 feet altitude if sown after the heavy part of the monsoon is over, sheltered from strong sunshine while young, and the soil kept moist; northward, it thrives in moist districts with little care.

LOBELIA TRIGONA—*Karakholi*.—A pretty creeping herb, with triangular stems and lobelia flowers, indigenous in wet places.

LOBELIA NICOTIANÆFOLIA⁴—*Doeul*—forms a handsome rock-work plant. It is raised by sprinkling the seed on the higher parts of rock-work kept regularly moist and thinned out greatly, as one plant in five is sufficient. Western Ghats.

ISOTOMA LONGIFLORA⁵—*Raventa-cavillos*.—An herbaceous plant, with white flowers having a long white

¹ *Campanulaceæ*, from the genus *campanula*, a little bell.

² *Media*, medium.

³ *Lobelia*, after Mathias de L'Obel, a botanist and physician to James I., 1538-1616; *erinus*, from Erinnyes, one of the fairies.

⁴ *Nicotianæfolia*, having leaves like the tobacco plant.

⁵ *Isotoma*, from *isis*, equal, and *toma*, a section—segments of the corolla being equal; *longiflora*, long-flowered.

tube. The plant grows very freely on moist rock-work or by the sides of irrigation channels. It is poisonous to horses, and on the human system is fatally cathartic.

ERICACEÆ,¹ *The Heath Family.*

This is a cool-climate group of plants, found in the tropics at an altitude of 5,000 feet upwards, but generally capable of cultivation at lower altitudes by planting on the shady side of a building or by selecting a cool exposure and mixing a portion of the soil natural to such plants with the compost prepared for planting. This soil should contain one-half its bulk of *Peat*, a soil consisting largely of the decayed remains of plants, and found only in temperate climates--the Swamp Peat of Bengal, formed of the roots of plants in shallow water, is a near relation, and in some instances acts as a substitute; but true peat accumulates only in cool moist climates, and contains the mycelium of a fungus (the silver thread of the mushroom grower), which, no doubt, serves as an intermediary in the absorption of food.

PIERIS FORMOSA, from Himalaya, is a fine evergreen shrub, fit for 5,000 to 7,000 feet altitude, with peat soil.

AGAPETES BUXIFOLIA, from Himalaya.

PENTAPTERYGIIUM SEPPENS, a shrub from Himalaya, with alternate exstipulate leaves and flowers, five angled, ten staminate, red, in pairs, hanging, about 1 inch long.

RHODODENDRON² AUCKLANDI, with white flowers 5½ inches wide; R. MADDENI, R. DALHOUSIÆ, and R. EDGEWORTHII have white flowers, and grow from 5,000 feet altitude upwards, and may be cultivated at a somewhat lower level in a moist climate with a peaty soil.

¹ *Ericaceæ*, from the genus *erica*, derivation doubtful.

² *Rhododendron*, from *rhodos*, a rose, and *dendron*, a tree.

PLUMBAGINEÆ,¹ *The Plumbago Family.*

This small group has a few popular garden plants. Acrid blistering properties prevail in the family, and in a dry cool climate they are easy to cultivate.

PLUMBAGO ZEYLONICA²—*Chitrak*.—A handsome indigenous shrub, having alternate entire acute leaves and long spikes of white five-lobed flowers, and a calyx with glandular hairs.

PLUMBAGO ROSEA³—*Lal-Chitrak*—differing chiefly in the red colour of the flower.

PLUMBAGO CAPENSIS⁴—*Asmani-Chitrak*—is very pretty when grown on a trellis protected from the sun. It runs up the trellis about 6 feet and throws out spikes of lovely pale blue flowers 18 inches. At Bangalore, being trimmed to 18 inches in height, it is used as a margin for wide roads with fine effect. Propagated by cuttings.

PRIMULACEÆ,⁵ *The Primrose Family.*

This is a group of herbs, chiefly native of temperate climates.

ANAGALLIS ARVENSIS⁶—*the Pimpernel, Jonk-mári, Jainghani*.—A charming, but poisonous, herb, with opposite entire leaves and solitary axillary stalked flowers, $\frac{1}{2}$ inch in width, of a deep blue with crimson eye, red or

¹ *Plumbagineæ*, from *plumbum*, lead, the plant is said to be efficacious in curing the lead disease.

² *Zeylonica*, from Ceylon.

³ *Rosea*, rose-coloured.

⁴ *Capensis*, from the Cape of Good Hope.

⁵ *Primulaceæ*, from the genus *primula*, from *primus*, first, in allusion to its early flowering in spring.

⁶ *Anagallis*, from *anageleo*, to laugh again, removing despondency—name given on account of supposed medicinal virtues; *arvensis*, inhabiting ploughed fields.

white, and appearing December to April. A widely distributed plant, it grows wild by the side of the irrigation channels and other moist places. Propagated by seed.

PRIMULA DENTICULATA and P. PURPUREA are pretty Himalayan flowers, which bloom in spring if sown during the previous summer at altitudes from 3,000 feet upward.

PRIMULA SINENSIS—the Chinese Primrose.—May be raised from seed sown at the end of the rainy season, and in the districts that have a mild cold season attains fair development before it gives way to the heat. A position sheltered from the sun yet with abundant light and a sandy soil carefully watered are the necessary conditions for its culture.

CYCLAMEN¹ PERSICUM.—The conditions detailed above are also suited to the *Cyclamen*. Seedlings are very delicate while young. Imported roots give flowers freely during some months in the cold season with ordinary care.

SAPOTACEÆ, *The Sapodilla Family.*

A small group of trees, valued in gardens for the perfume of the flowers of *Buchul* (*Mimusops elengi*) and the Sapota fruit. Propagation in this family is most easily effected by seed sown within two months of ripening, and in the meanwhile kept in the fruit. Layers may also be employed, but a long time is required to get good roots.

ACHRAS² SAPOTA—*Chicoo, Sapodilla, Neesberry*.—Sapota is a small fruit-tree of slow growth, which thrives in a reddish loamy soil near the sea, but grows fairly in alluvial soil in the Deccan. Water sufficient to keep the soil moist should be given while young; but after the tree is established with its roots a considerable depth in

¹ *Cyclamen* = circular, probably referring to the corn or "root."

² *Achras*, the Greek name for the wild pear.

the soil, water should be given in large quantities once a month in dry weather. The fruit ripens from November to March, and usually brings a high price in the market.

Seedlings of this tree have upright stems with branches in whorls spreading nearly at right angles, and the fruit varies to a great extent; therefore, although layers do not make as handsome trees as seedlings, they bear fruit sooner, and its quality will be exactly the same as the parent under similar treatment. Upright growing branches of the best sorts should be grafted on roots of the common sort.

The fruit is egg-shaped, of a brown colour, and rough skin. A cross section shows a star-like arrangement of black seeds and abundant milky juice.

MIMUSOPS¹ ELENGI—*Buchul, Bolesarae, Taindu*.—A large tree of slow growth, having leaves $3\frac{1}{2}$ by $1\frac{1}{4}$ inches, smooth and rhomboid at the base, with numerous slender nearly horizontal nerves, and a stalk $\frac{1}{4}$ -inch in length; it bears an immense number of small, white, sweet-scented flowers, having a corolla of sixteen to twenty narrow lanceolate lobes, succeeded by an egg-shaped yellow one-seeded berry. It thrives in deep alluvial soil on a river bank or on the banks of a tank. Propagate by fresh seeds.

CHRYSOPHYLLUM² CAINOTO—the *Golden Leaf, Ratalawulu, Sinaipala-pallam*—is a small tree of the West Indies, growing in moist districts better than in dry climates, having the under side of the leaf covered with very short golden hairs. A soil formed of a mixture of building rubbish with good loam in equal parts suits it well. Propagate by fresh seed, obtainable from Ceylon, and water freely until the tree is established; afterwards, ordinary rainfall is sufficient.

¹ *Mimusops*, from *mimus*, an ape, and *opsis*, resemblance, in allusion to a fancied resemblance between the flowers and an ape's countenance.

² *Chrysophyllum*, golden-leaved, in allusion to the golden appearance of the under side of the leaf.

DATE PLUM—*Chrysophyllum monopyrenum*.—A West Indian tree adapted for low level cultivation; the fruit has an edible, reddish, milky pulp and one seed, and is in season during February to April.

ARGAN TREE—*Argania sideroxylon*.—A tree of South Morocco, growing freely from 59° 32' N. lat., and bearing fruit like plums, the pulp being good food for goats and other cloven-footed animals, and the kernels yielding an oil greatly valued; the whole fruit is eaten and the hard nut disgorged when the animal is at leisure. This tree should thrive at the same latitude in Northern India, and might be introduced with advantage.

MYRSINÆ,¹ *The African Myrtle Family.*

A group of shrubs or small trees with alternate, undivided, gland-dotted leaves; a few are attractive garden plants.

ARDISIA HUMILIS ²—*Kadna - Banjam, Kantena - Bodinagidda*.—An erect-growing shrub having leathery leaves, 6 by 2½ inches, and pendulous umbels of bright pink flowers succeeded by a black berry. Propagated by seed, and thrives with ordinary treatment.

JACQUINIA RUSCIFOLIA.³—A shrub of dense habit, having narrow, lance-shaped leaves, ending in a sharp point, and bearing small, starlike, bright orange, pretty flowers. This shrub bears clipping, and serves as a guard post at corners. As a border shrub it thrives in Bengal without special care; in the Deccan its growth is extremely slow. Propagated by seed.

¹ *Myrsinæ*, from the genus *myrsine*, an old Greek name used by Dioscorides for the myrtle.

² *Ardisia*, from *ardis*, a point, in allusion to the pointed anthers. *Humilis*, humble.

³ *Jacquinia*, named in honour of Nicholas Joseph de Jacquin, 1727-1817, once professor of botany at Leyden. *Ruscifolia*, having leaves like the butcher's broom.

EBENACEÆ, *The Ebony Family.*

DIOSPYROS EMBRYOPTERIS—*Timburi, Guab* of Central Africa.—A tree of dense habit of growth, having thick, shining, alternate, entire, deep-green leaves, about 5 by 2 inches. Male flowers, $\frac{1}{4}$ inch diameter; female flowers twice as large, on separate trees. In a shady, irrigated garden, this tree is attractive from its foliage.

The *Japanese Persimmon*, DIOSPYROS KIKI, is a fine fruit tree, adapted for dry mountains in the tropics, 3,000 to 5,000 feet altitude, or South France, South Africa, South China, Japan, or near the Mediterranean. The fruit that is sent to market is seedless, and weighs from 4 to 8 ozs. It is smooth and generally yellow, becoming red as it ripens, and has a prominent calyx of four leaves. Very nice to eat when thoroughly bletted by being kept for some time after collecting, therefore fit for carriage a long distance if properly packed. If practicable, in raising those plants begin with a stock of good sorts planted 15 feet apart, on good soil, and a porous jar to contain water sunk to the brim at the root of each, this jar to be filled at intervals when quite dry. If raised from seed, many will be male, and may be converted into fruit-bearing plants by enarching. Plants are cultivated in the Public Gardens, Utikamund.

OLEACEÆ,¹ *The Olive and Jasmine Family.*

A group of trees and shrubs of importance as the source of olive oil, and yielding many sweet-smelling flowers. As a rule, propagation by cuttings is easy, but the olive is propagated by taking the suckers which spring up near the stem of the parent plant with a portion of the root, or by seed, the good varieties being budded on to the seedlings.

¹ *Oleaceæ*, from the genus *olea*, from *olaia*, an olive tree.

OLEA SATIVA—*the Olive Tree*.—The olive tree grows freely in the Deccan when treated as a garden tree, but rarely flowers and never ripens fruit. In West Himalaya a suitable climate will be found about 4,000 feet altitude.

OLEA CUSPIDATA¹—*Rahu, Ran, Shwan*.—A bushy tree of North-west Himalaya and Kashmir, having opposite, oblong, entire, leathery leaves, $2\frac{1}{2}$ by $\frac{3}{4}$ inches, pointed or blunt, and having the nerves on the lower side of the leaves obscured by ferruginous felted scales. This tree grows freely with ordinary border treatment, and may be transplanted safely when of large size. The flowers are small and rarely produced in the plains.

OLEA DIOICA—*Pan-jambul*.—A small tree of the Ghats with opposite leaves and white flowers about $\frac{1}{8}$ -inch. in diameter, having a faint, agreeable odour. The flowers become brown as they ripen, and, falling, carpet the ground. It is increased by seed, and bears transplanting when of considerable size.

OSMANTHUS FRAGRANS²—*Silang*.—A small tree of Kumaun. One of the choicest garden shrubs. Its leaves are opposite, entire or saw-edged, rigid, leathery, of a bluish-green tinge, and attain 7 by 2 inches, but are usually much smaller. Its flowers are small, white, with a four-lobed corolla, fragrant, and produced in dense bunches from the ends of the branches or the leaf axils during the cold season. The flowers are used for perfuming superior sorts of China tea. In dry districts this shrub thrives well with ordinary garden border treatment. It is propagated chiefly by layering—which is a tedious process—and also strikes root freely from cuttings of half-ripened shoots inserted in sand covered with a bell glass and kept inside a shaded garden frame; but it grows better grafted on a jasmine root.

¹ *Cuspidata*, having sharp, stiff points.

² *Osmanthus*, from *osme*, perfume, and *anthos*, a flower. *Fragrans*, fragrant.

JASMINUM.¹—The species and varieties of this genus, including *Jai*, *Mogra*, are much valued as flowering plants; all thrive in good loamy soil, and require to have the branches that have given flowers cut back to half length about a month after flowering. At the same time, manure should be dug in about the roots and a liberal watering given, then fresh flower shoots will appear, and three crops of flowers yearly may be obtained from some of the kinds.

JASMINUM SAMBAC.²—*Mogaree*, *Moota-bella*, *Burra-bella*.—A dwarf spreading shrub, having opposite, entire, nearly sessile, heart-shaped or oblong pointed leaves, and double sweet-smelling flowers produced in dense cymose branches. It is propagated by layers.

JASMINUM HUMILE.³—*Hemapupika*.—A rigidly erect shrub, having alternate pinnate leaves of three or more rhomboid, oblong, leathery leaflets of a deep green colour and variable in size, but often $\frac{3}{4}$ inch by $\frac{1}{2}$ inch, and bright golden flowers $\frac{3}{4}$ inch in expansion in terminal corymbs of ten to twenty flowers. Ordinary border treatment suits this species well. Propagated by cuttings.

JASMINUM GRANDIFLORUM.⁴—*Malutee*, *Jatee*, *Kund*, *Jati-jai*.—A shrub with spreading pendulous branches when growing in an open place, but twining freely when shaded, and bearing opposite pinnate leaves of about eleven rhomboid oblong leaflets less than an inch in length. The flowers are pure white, circular, $1\frac{1}{2}$ ins. in expansion, and sweet-scented. This shrub in flower, seen by moonlight, is charming. Ordinary garden treatment and propagation by cuttings suit it.

JASMINUM CALOPHYLLUM.⁵—A shrub of slightly scandent habit, and bearing opposite leaves of three

¹ *Jasminum*, from its Arabic name.

² *Sambac*, Arabian.

³ *Humile*, dwarf, humble.

⁴ *Grandiflorum*, large-flowered.

⁵ *Calophyllum*, beautiful-leaved.

ovate, acute leaflets, and pure white ten-lobed flowers 1 inch in expansion. This plant is grown with fine effect at Baroda.

JASMINUM MALABARICUM—*Kursar* (long called *Jasminum latifolium*).—A rambling shrub common on hill ranges of West India. It bears white fragrant flowers in profusion, and given a climate wet from June to October, it grows without care. Propagate by seed and cuttings.

JASMINUM PUBESCENS¹—*Ran-mográ*.—A climbing shrub with branches and leaves softly hairy. The leaves are short-stalked, ovate, lanceolate, $2\frac{1}{2}$ by 1 inch, rounded or cordate at the base, and densely covered with short, soft hair. The flowers are white, somewhat fragrant, 1 inch in diameter, double in garden varieties, in dense heads at the ends of branches, and having full-sized leaves close under the flowers. A satisfactory plant for a trellis. It is indigenous in hilly districts, and does not require special care. Propagated by seed and cuttings.

JASMINUM UNDULATUM.²—Resembles the above, but with less pubescence.

NYCTANTHES ARBOR-TRISTIS³—*Harsinghar, Parajatak*.—Grows in any garden soil, and blooms nicely with slight shade. Is propagated by seed or cuttings. It may be identified by its peculiar habit of casting off the fragrant white corolla, with an orange tube, early in the morning.

¹ *Pubescens*, having short, soft hair.

² *Undulatum*, wavy.

³ *Nyctanthes*, *nyx*, night, and *anthos*, a flower, in allusion to its habit of opening its flowers at night. *Arbor-tristis*, sad tree, alluding to its opening flowers at night and casting them in the morning.



STAPELIA

ADENIUM OBESUM.

APOCYNACEÆ,¹ *The Dogbane Family.*

A group of shrubs and climbers remarkable for the beauty of their flowers. The greater number of members of this family have opposite entire leaves and milky sap, and are distinguished from *Asclepiadaceae* by the pollen being powdery instead of cohering in masses. The plants grow freely in a rich garden soil, well drained, and are propagated by seed or layers and by budding superior on to common varieties. A few of the species may also be propagated easily by cuttings.

The DOGBANE FAMILY has many rubber plants, and a general similarity to the next order--*Asclepiadaceae*. There is no straight line separating the two groups, it is rather by the predominance of certain important characters that the families are recognised; but one character is of valuable practical use: *Apocynaceae* has pollen like dust; *Asclepiadaceae* has pollen coherent in small masses.

ADENIUM OBESUM²—*Adenacha-knaner*, *Aden.*—A remarkable plant, rare in gardens, with a thick, gouty stem rapidly diminishing to short stout branches, which, during the hot season, are gay with numerous bright, rosy, Oleander-like flowers. During the rainy season oblong leathery leaves, crowded at the end of the branches, appear. A fine specimen in the Poona Botanical Garden, in cultivation over thirty years, was scarcely three feet in height. This plant is a native of Aden, and in dry districts thrives with full exposure if planted in a mixture of good loam one part and crushed bricks two parts, and carefully watered, giving a good soaking at intervals of fifteen days or so during dry weather.

¹ *Apocynaceæ*, from the genus *apocynum*, from *apo*, away, and *byon*, a dog, adopted by Dioscorides because the plant was supposed to be poisonous to dogs.

² *Adenium*, from Aden, its natural habitat. *Obesum*, *obesa*, referring to the swollen stem.

CRYPTOSTEGIA GRANDIFLORA¹—*Vilya Vakundi*.—An elegant climber of tropical Africa. Grows throughout Western India on good soils, such as a thicket on a river bank, or a hedgerow. It yields rubber of the finest quality, as shown by Mr. Birdwood, who produced it in quantity; but in my hands the cost of collecting was the same as the price to be obtained for it, so at that time there was no profit, but now it may be otherwise. There is no question of the quality. The plant grows nicely in dry climates, with slight shape. It bears elegant rosy flowers, about 1½ inches in expansion, succeeded by triangular fruit in pairs, each 5 inches in length, and 1½ inches in width at the widest part. The leaves are opposite, entire, smooth, 3 to 4 inches long. This plant is also called *Metivuli*, *Humbu*.

AGANOSMA CARYOPHYLLATA.—A woody climber having milky sap, opposite entire leaves with veins coloured red, and abundant pure white flowers, 2 inches in expansion, with the perfume of cloves. It thrives in dry districts on a deep soil, watered occasionally, and grows over high trees. A very valuable garden plant described as *Echites caryophyllata*² in Roxb. *Fl. Ind.*, p. 245. Propagate by layering.

PALAEQUIM GUTTA —the *Gutta-percha Tree of Malaya*.—The gutta-percha tree grows in the forests of that hot, moist region. It may be raised from seed if a small handful be planted where the tree is wanted to grow, about 10 feet apart, in a forest of other trees, which are removed gradually as the gutta-percha plants grow up. Hillsides well covered with heavy indigenous forests are employed. It requires about ten years for the planted trees to attain yielding size, hence the sap has principally been collected from wild trees hitherto.

¹ *Cryptostegia*—*cryptos*, concealed, and *stego*, to cover; in reference to the scales in the throat covering the anthers. *Grandiflora*, large-flowered.

² *Echites*, a viper, probably referring to the acrid nature of its sap.

PALAEQUIM ELLIPTICUM—*the Pala Gum*.—A large tree of the forest of South India. Grows freely with heat and moisture in the atmosphere, and may be increased by seed. The pala gum is used for mixing with gutta-percha.

The process of preparing the rubber for market may be quoted:—Large trees are tapped once every three months, and yield about a quart. The milk is brought to the yard and kept about two days, then strained through a cloth and an equal quantity of water added. One pint of mixture is placed in an earthen pot and the pot placed in a large vessel with water just below boiling. 1 per cent. of carbonate of potash is added, and stirred with a wooden spoon till coagulation, which takes three to four minutes. As soon as the rubber coagulates, the dollop of rubber is placed in a press such as letters are copied with. Each lump is separated by boards, which bear the initials of the firm; pressure is applied, and the water runs out. The thick cakes of rubber are then dried on shelves made of reeds.

Seed is procurable from the Botanic Station, Largs.

ALLAMANDA CATHARTICA GRANDIFLORA.¹—A choice yellow-flowered climber, thriving when planted in a bed or large tub of rich, well-drained soil. It improves the flowering if the branches are thinned out during the hot season, all weakly ones being removed and a supply of thoroughly decayed manure given. Propagate by layering of well-ripened branches. A fine specimen of this plant may be seen at Kirkee, on the eastward end of a house, where it is protected from the prevailing wind and exposed to the morning sun only. The soil it is growing in is black loam, 18 inches in depth, overlaying decayed trap (*moorum*), which provides good drainage, and a water-pipe near by ensures abundant water.

¹ *Allamanda*, from Allamand, a surgeon who travelled in Guiana. *Grandiflora*, large-flowered.

ALLAMANDA NERIIFOLIA.¹—An erect glabrous shrub 3 feet in height, having opposite or whorled, oblong, acuminate leaves on short petioles, and deep golden-yellow flowers, between funnel and bell shape, the tube being 1 inch in length. This plant thrives with ordinary border treatment, and is propagated by cuttings and layers.

BEAUMONTIA GRANDIFLORA²—*Barbari-luta*—and B. JERDONIANA³ are grand climbing plants, producing large white flowers during the cold season. Any rich well-drained and watered soil is suitable. It thrives from the seashore to 3,000 feet altitude. Propagate by layers.

CARISSA CARANDA⁴—*Kurwanda*, *Avinga*, *Kristna*, *Pakphala*, *Karumcha*.—A well-known shrub, useful in wet, hilly districts as a fence and for its fruit. It is propagated from fresh seed.

CARISSA BISPINOSA—*Amatungula*.—A pretty shrub from Natal, resembling *Kurwanda*, but having the spines twice-forked. May be propagated by half-ripe cuttings under a bell glass or by seed.

CERBERA ODOLLAM—*Katarali*, *Dabûr*, *Kadama*, *Odallam*, *Harki* (Sylhet), *Belutta-kaka-kodi* (Malay).—A small tree, native of salt swamps near the shore of various parts of India, but thriving in ordinary soil watered frequently. The leaves are 3 to 8 inches by 1 to 2 inches, alternate, lanceolate, smooth, leathery, with transverse very slender nerves, narrowed into a short, stout petiole. The large cymes of pure white flowers, 1 to 3 inches in diameter, are succeeded by

¹ *Nerifolia*, having leaves as in *nerium*.

² *Beaumontia*, in honour of Mr. Beaumont, of Bretton Hall, Yorkshire.

³ *Jerdoni*, Jerdon's.

⁴ *Carissa*, from the Sanskrit name; *caranda*, from the Marathi, *Kurwanda*.

globular or egg-shaped fruit, 3 inches in diameter, containing a single seed. Scarcer than it should be in gardens owing to the difficulty of getting seed, which should be set immediately after ripening.

CERBERA NERCIFOLIA—*Velaitee, Kuner*.—A shrub of rapid growth, having narrow, linear, alternate leaves, and bearing abundant yellow flowers at the ends of the branches. It is useful as a screen to shut out offensive objects or break the wind. Propagate from seed.

CERBERA TANGHIN—*Tanghin*.—The Poison Tree of Madagascar, which in former times was used as a trial of the guilt or innocence of the person in Madagascar. May be cultivated wherever abundant moisture in the air or at the root can be obtained. It has the aspect of *Plumieria acuminata*.

CHONEMORPHA MACROPHYLLA.¹—A large, milky climber, native of moist districts, having stout branches covered with ovate warts and opposite broadly oval pointed leaves, attaining 12 and 10 inches, and erect cymes of white, fragrant flowers about 4 inches in expansion, produced freely during the hot season. It thrives at Poona and at Bombay with ordinary garden treatment.

DIPLADENIA CRASSINODA.—A climber having dark green opposite leaves, with a distinct pale green mid-rib, and bearing at the ends of the branches rosy purple flowers of thick texture. A rich, friable, open border, regularly watered, suits it at an altitude of 2,000 feet. It is propagated by cuttings half ripe on a hot bed, or by layers.

FUNTUMIA ELASTICA—the *Largos Silk Rubber*—is a large tree, and yields a good quality of rubber in Africa, but in Ceylon is subject to the leaf roller, *Caprinia concadylis*, against which arsenical preparations are advised (*Kew Bull.*, 5, 1907).

¹ *Chonemorpha*, from *chone*, a funnel, and *morphe*, form, in allusion to the form of the corolla.

HÆMADICTION VENOSUM.—A delicate but elegant plant, valued for its opposite, ovate, acuminate, pale pea-green leaves, having the mid-rib and nerves translucent red. It grows fairly in a pot with rich loam mixed with an equal quantity of pounded bricks and shaded from direct sunshine.

HOLARRHENA ANTIDYSENTERICA—*Conessi bark, Kuda, Dowla-Kura, Kureya, Vepallei kura.*—A shrub of the Western Ghats producing, during the hot season, creamy white flowers, succeeded by a long pair of slender follicles cohering at the apex. It thrives in gardens with ordinary treatment. Propagated by seed.

LANDOLPHIA FLORIDA (Aboli fruit)—the Mbungu rubber plant.—This climber is not only of importance as a source of rubber in West Africa, but is highly ornamental, with abundant white flowers resembling *Kurwanda*. It grows freely in the climate of Madras with ordinary garden treatment, and is propagated by layering.

LANDOLPHIA KIRKII—"Matere" Rubber—is similar to the above.

ASCLEPIDACEÆ,¹ *The Asclepiad Family.*

A family resembling the last, but distinguished by having the stamens cohering round the pistil and the pollen in masses joined in pairs. The cultivation required is very similar to the last, a deep, well-drained soil being generally suitable. A distinct rest during the cold and early half of the hot season may be allowed with advantage. Propagation by seeds and layers.

ASCLEPIAS CURASSAVICA—*Kurki, Kakatundi.*—A West Indian herb, with a nearly simple stem bearing opposite lance-shaped leaves, and terminated by flowers

¹ *Asclepidaceæ*, from the genus *Asclepias*, the Greek name of *Æsculapius*.



FREREA INDICA.

having bright maroon, reflexed petals, and a central orange column. It grows freely from seed if the soil be especially damp. In the West Indies the root is used as an emetic, and the milky sap to form a protective pellicle to abrasions of the skin.

CALOTROPIS GIGANTEA¹—*Rui, Ak, Mandar, Urka, Ulurka*.—The white variety of this plant is well worthy of a place in gardens, because some of the white flowers have as pure a colour as it is possible to find among flowers. White flowered plants of this species are met with rarely over the great range of the common sort. When such a plant is found in fruit, a string should be tied round the fruit to prevent the seed from being blown away when ripe. In due season the seed may be gathered and sown in the garden on a loose, stony soil. When the young seedlings appear, the stem near the ground should be examined, and all that show a purple tinge pulled out, because such plants would produce the common purple variety. Plants having pure white flowers may be propagated by layering. This is one of the five darts levelled by Vishnoo at the hearts of young mortals; *Michellia champaca*, is another.

It is found that *Calotropis gigantea* is recommended as a rubber plant in a recent publication. I have tested this plant often, and never found it to contain rubber. It may do so at certain seasons, but I never found any. If it is found to contain any rubber, its congenous plant, *Calotropis procera*, which grows abundantly on the sides of the railway in Scind, should be tried.

FREREA INDICA—*Shindal-makudi*.—A herb of extremely local occurrence and rarity. Was discovered on a hill near Junir, Poona, by Mr. Dalzell, but long baffled the efforts of other collectors, until Mr. N. B. Ranade undertook the search, and brought plants to

¹ *Calotropis*, beautifully twisted, in reference to the filaments of *Calotropis gigantea*.

Poona, which were planted and photographed when in flower. Mr. Ranade died soon after, and specimens of the plant are still very rare in herbaria. The flowers are maroon coloured, and the corolla has pendulous vibratile cilia on the margins of the lobes. The illustration is two-thirds natural size.

GYMNEMA SYLVESTRIS.—An evergreen climber, having opposite, entire, smooth, dull, green leaves about 2 inches by 1 inch, and umbells of small yellow flowers. The plant is very interesting from the fact that, on being chewed, it causes the power of tasting sugar to remain in abeyance several hours. The taste of the leaves is not disagreeable, and the effect completely passes away after some time. The plant abounds in Sumpkund, North Kanara. It grows slowly at Poona, planted in loamy soil, occasionally watered, and may be propagated by layering or seed.

HEMIDESMIS INDICA (Indian Sarsaparilla)—*Anantamul, Dudha sáli, Nannári, Upalsari, Uperçao, Soucandi, Karibanta.*—A creeping or climbing plant having opposite leaves varying from nearly circular to linear, the mid-rib with a white cloud. This pretty plant grows freely on rocky soil, and is so much used in medicine that it is advisable to have some at hand. Its demulcent alterative tonic and other properties are detailed in *Pharm. Ind.*, II. 446. The aroma of the root is agreeable, and said to resemble tonka bean or melilot.

HOYA CARNOSA¹—*the Wax Plant.*—An elegant climber which roots on the bark of trees in moist forests. Its flowers are rosy-white, waxy, and in clusters, and its leaves opposite, entire, elliptic, thick, smooth, leathery. It thrives in moist air and shade, and may be trained on a wooden pillar or stump with a loamy soil rich in leaf-mould and crushed shells or

¹ *Hoya*, named after Mr. Hoy, once gardener to the Duke of Northumberland at Sion House. *Carnosa*, fleshy.

bricks. Propagate by cuttings or leaves planted as cuttings.

HOYA GRIFFITHI.—A native of Eastern Bengal, has the thick, elliptical, entire leaves common in the genus and umbels of rosy flowers rather larger than *Hoya carnosa*.

Numerous other varieties are in use.

STAPELIA GRANDIFLORA.¹—A dwarf succulent plant, having short, four-angled, leafless stems in groups, and bearing brown, hairy flowers 3 inches in diameter, with a foetid odour. This plant thrives on a dry bank with little care.

STEPHANOTIS FLORIBUNDA.²—This choice climber requires a rich, loamy soil, which may be formed by mixing good garden soil, one part; decayed leaves one part; and broken bricks or pots, one part. If the soil does not contain abundance of lime, a small quantity taken from an old building may be used with advantage. Perfect drainage and regular watering, sufficient to keep the soil moist, is necessary. When fully exposed to the sun, the leaves of this plant sometimes become burned and unsightly; by planting it in a pit filled with the above compost, and giving a north-east exposure, this burning of the leaves is avoided.

PERGULARIA ODORATISSIMA³ (Cowslip Creeper)—*Tonki, Kunja luta*.—An elegant climber, having cordate, acuminate, soft, downy leaves, attaining 3 inches, and umbels of greenish-yellow fragrant flowers. It thrives with a rich loamy soil kept open by a liberal admixture of broken bricks, and slight shade, and may be propagated from seed or cuttings of young growth with a heel of old wood inserted, as detailed on page 25.

¹ *Stapelia*, named by Linnæus in honour of Stapel, an Amsterdam physician.

² *Stephanotis*, *stephanos*, a crown, and *ous otis*, an ear. *Floribunda*, having many flowers.

³ *Pergularia*, from *pergula*, an arbour, referring to the suitability of the plant.

OLEANDER—*Kuner, Sweta, Raravira, Kurubi*, white variety; *Rukta Kurubi*, red variety.—The improved varieties of this plant are among the finest flowering shrubs. The flowers vary from white to dark crimson, the perfume is sweet, they last well when cut, are produced at intervals throughout the year, and the pure white double sort is most useful for bridal bouquets. A sandy or stony soil with irrigation available is suitable, and the banks of a water course are favourable. After flowering, the shoots that have flowered should be shortened to one-third their length and a free supply of manure dug in near the root. The best varieties may be budded on to common sorts during the rainy season, but layering is advisable. The plant is poisonous.

PLUMIERIA ACUTIFOLIA¹—*Khair Champa, Gul-achin*.—A small tree with milky sap, in leaf only during the rainy season, and bearing large sweet flowers with golden centre, from the ends of stout branches. As commonly seen, this tree is not considered ornamental, but if a branch 2 feet in length, with several short shoots, be planted during February in a circular flower bed with rich sandy soil and watered occasionally, the leaves appear in due season much larger than usual, and with them abundant flowers, so low that their full beauty is well displayed. The tree is a native of Tropical America, and rarely produces its spindle-like fruit, 8 inches in length and 1 inch diameter at the middle.

PLUMIERIA ALBA² thrives under the same conditions as the last. It retains its leaves, and has pure white flowers, and is scarce.

RAWOLFIA SERPENTINA—*Chaot-Chand, Chandra*.—A charming small shrub, or in strong soils a climber bearing alternate, exstipulate, entire smooth leaves 4 to 5 inches by 2 inches. The flower-stalk and calyx bright

¹ *Plumieria*, in honour of Plumier, a celebrated French botanist; *acutifolia*, sharp-leaved.

² *Alba*, white.

red and the corolla white; produced abundantly in slight shade with moist soil.

ERVATAMIA CORONARIA (formerly *Tabernaemontana coronaria*)¹—*Tagur*, and *Burra tagur*, the double variety—are very choice white-flowered shrubs, resembling *Gardenia*, but with milky sap, and thriving in any well-drained and watered garden soil, and easily propagated by cuttings, planted in January or February.

VALLARIS HEYNII.²—A pretty climbing shrub, having opposite, elliptic or oblong, pellucid, dotted leaves, and pubescent cymes of white salver-shaped flowers 1 inch in expansion. The undernoted are very desirable garden plants belonging to this order, which are cultivated in the same manner as the preceding:—

*VINCA ROSEA*³ is a well-known undershrub, with rose or white flowers, propagated by seeds. It is hardy enough to spread freely when introduced into a garden.

VINCA MINOR VARIEGATA.⁴—A trailing plant with opposite, very short, petioled, entire, ovate leaves, variegated with creamy white; it grows nicely from 3,000 to 7,000 feet altitude.

*WRIGHTIA ZEYLONICA*⁵ are shrubs with dichotomous branches, elliptical leaves, 3 to 5 inches by 1½ to 2 inches, and puberulous white flowers 1½ inches in diameter, produced very abundantly during the hot season.

¹ *Tabernaemontana*, in honour of Theodore, surnamed Tabernæmontanus, from the place in which he was born; *coronaria*, crowned.

² *Vallaris*, perhaps from *vallo*, to enclose—the plants are used for fencing in Java; *Heynii*, after Dr. B. Heynes, the first naturalist attached to the Mysore survey.

³ *Vinca*, or *perivinca*, was the old Latin name used by Pliny; *rosea*, rose-coloured.

⁴ *Minor*, smaller; *variegata*, having different colours.

⁵ *Wrightia*, named after William Wright, a Scotch botanist; *zeylonica*, from Ceylon.

WRIGHTIA COCCINEA.—A shrub resembling the above, but with brick-red flowers; Himalaya (*Bot. Mag.*, 2696).

ROUPELLIA GRATA.¹—A woody climber from Tropical Africa, attaining 20 feet, has opposite, entire, bright, shining, elliptical leaves, and producing during the hot season terminal masses of pale rosy flowers, 2½ inches in expansion, having a ring of processes arising from the thick corolla lobes.

LOGANIACEÆ, *The Nux-Vomica Family.*

This tribe of plants is represented by

BUDDLEIA ASIATICA.—A free growing shrub, having lanceolate leaves, white beneath, and dense racemes of small white, sweet-scented flowers. It thrives in northern districts or at moderate altitudes in southern, and easily propagated by cuttings.

BUDDLEIA COLVILLEA, of the Himalaya, grows at 10,000 feet altitude, but may be cultivated at 4,000 feet upwards.

BUDDLEIA LINDLEYANA has purplish-red leaves.

STRYCHNOS NUX-VOMICA—*Kajra Kasarkano, Goda-Kaduru*—a tree bearing opposite, stalked, oval, smooth, entire edged, three-ribbed leaves, of a bright green when mature and of lively red when young, bearing small greenish-white flowers in corymbs, at the ends of the branches, followed by fruit the size and colour of an orange, which contains, in yellow pulp, circular finely silky seeds well known as nux-vomica. The tree needs a heavy rainfall and moist climate, similar to its habitat, the Concan. Propagated by seeds.

STRYCHNOS POTATORUM, the Clearing Nut, or Indugo or Terrankota tree, grows in dry forests of the Taluga country.

¹ *RouPELLIA*, named in honour of the Roupell family, encouragers of botany; *grata*, agreeably scented.

STRYCHNOS COLUBRINA, the *Roochila lata*, from the hills near Silhet, is scandent, with simple tendrils, and grows in moist mild regions.

GENTIANACEÆ,¹ *The Gentian Family,*

Is a group of herbs with opposite entire leaves of bitter taste, and a few water plants with alternate leaves. The family generally affects temperate climates, and in this country abounds in wet upland districts and in low damp spots in dry districts. Many plants of this family are annuals with showy flowers, which are difficult to cultivate, owing to the very minute seed germinating irregularly and the degree of moisture necessary being unsuitable for other garden plants, but the water plants *Limnanthemum*² are easily managed and are very satisfactory.

EXACUM BICOLOR resembles *Exacum tetragonum*, but is distinguished by the corolla lobes being white in the lower and azure blue on the upper half. Cultivate like *Exacum tetragonum*.

EXACUM PEROTTETII closely resembles the above, but is larger; the leaves are five- to seven-nerved, and the cymes are crowded with large pale blue flowers. Cultivate as above.

EXACUM PUMILE.—A beautiful herb, rarely exceeding 6 inches in height, with sessile, lanceolate, three-nerved leaves or with lower leaves one-nerved, and very numerous purple-blue flowers having four prominent yellow anthers. Cultivate as above.

EXACUM TETRAGONUM³—*Kuchuri*.—An elegant herb with quadrangular stem, broadly lanceolate, five-

¹ *Gentiana*, from the genus *gentiana*, from *gentiane*, the old Greek name used by Discorides.

² *Limnanthemum*, marsh flower.

³ *Exacum*, *ex*, out of, and *ago*, to drive; *tetragonum*, four-angled.

nerved, sessile leaves, and a large panicle of four-lobed azure blue flowers $1\frac{1}{2}$ inches in expansion. More efforts to grow this charming herb in gardens are wanted: it may be managed by sowing the seed thinly on good loam in pots at the beginning of the rainy season and keeping the pots standing in saucers with water.

LIMNANTHEMUM CRISTATUM¹—*Katara Chuli*.—An aquatic herb with floating circular or elliptic leaves about 4 by 3 inches, and dense bunches of white flowers, which appear to rise from the stalk of the leaf. The flowers are about 1 inch in expansion, and each petal has a longitudinal wavy fold crest-like in the centre. India-China.

LIMNANTHEMUM INDICUM—*Bura - Chuli, Antara Tamara, Kumudwuti*.—Resembles the above, but the flowers are larger, $1\frac{1}{2}$ inches in expansion, and each corolla lobe has a rich fringe of delicate white hairs, which render the flowers very attractive. This species is not as free-growing as the preceding. It is abundant in a tank on the "table land" at Panchgunny, altitude nearly 4,000 feet, and also in tanks at Calcutta.

HYDROPHYLLACEÆ,² *The Water-leaf Family.*

A small group of plants represented in our gardens by *Wigandia macrophylla*,³ a very showy, short-lived small tree, having a straight stem bearing alternate, hairy, heart-shaped leaves attaining 2 by $1\frac{1}{2}$ feet, on stout stalks, and at a height of about 10 feet producing scorpioid branches of small lilac flowers. It is propagated by seed and thrives in a very rich freely watered soil with high shelter from sun while young. When

¹ *Limnanthemum*, marsh flower. *Cristatum*, crested.

² *Hydrophyllaceæ*, from the genus *Hydrophyllum*, from, *hudor* water, and *phyllon*, a leaf.

³ *Wigandia*, named in honour of John Wigand, 1523-1587, Bishop of Pomerania. *Macrophylla*, large leaved.

well grown this forms a very imposing plant fit for the top of a rockery or the centre of a large bed. It lives about three years, and when established in a garden, seedlings spring up in the pots of other plants.

HYDROLEA ZEYLANICA—*Popti, Kerati*.—A spreading herb producing small deep blue flowers in great abundance; a charming ornament on the banks of a tank. It is a native of rice fields in the Konkan, and is propagated from seed and cuttings.

PHACELIA CAMPANULARIA is a hardy annual with deep blue flowers. If sown on a very moist border at 4,000 feet altitude upward, the blossom appears during the cold season.

POLEMONIACEÆ, *The Phlox Family.*

COBÆA SCANDENS.—A Mexican climber having leaves with three pairs of large leaflets, branched tendrils and large bell-shaped dark purple flowers, solitary on stout pedicles from the axils of the leaves. It thrives nicely in dry districts if planted out in the conservatory, and the variegated leaved form is specially ornamental. Increase by layers.

GILIA TRICOLAR is a dwarf annual fit for sowing on the northern side of a house, at 3,000 to 7,000 feet altitude after the rainy season.

LEPTOSIPHON HYBRIDS and **NEMOPHILA INSIGNIS** grow nicely at 4,000 feet altitude upward, if sown on a well-tilled border during August and October, and protected from sunshine and heavy rain.

PHLOX¹ **DRUMMONDII**.—A charming annual, flowering particularly well during the first three months of the year if sown in October and November, but in districts with light rainfall it may be sown as early as June, and

¹ *Phlox*, from the flame colour of the original.

brought into flower in September. If the seed be imported, and therefore costly, it may be sown thinly in pots, and when 2 to 3 inches in height, the flower bed may be thoroughly watered, and the seedlings set in the mud 4 inches apart, and carefully shaded, but otherwise exposed; it is better to sow where the plants are wanted to flower rather than to transplant. A loose sandy but rich soil having plenty of leaf mould in it, and regular watering is desirable.

PHLOX, PERENNIAL.—In districts with an altitude nearly 2,000 feet and light rainfall, the perennial Phlox may be grown with gratifying success. As the plants get little rest, grand heads of bloom are not to be expected. The most successful grower at Poona keeps his Phlox in pots in a rich friable compost, and gives regular and abundant water and no shade. The result is the plants are in bloom almost throughout the year, but especially from January till June. Propagate by division.

BORAGINÆÆ,¹ *The Borage Family.*

A group of herbs, shrubs, and trees with alternate, entire, hisped leaves and an inflorescence curling downward and inward.

BORAGO OFFICINALIS—*Borage.*—An herb with leaves of two forms: the lower or radical leaves ovate and attenuated at the base into a long stalk; the upper or cauline leaves are oblong, sessile, and the flowers blue, purple, or white, about $\frac{3}{4}$ inch in expansion, and in the Deccan produced abundantly during September and March.

CORDIA SEBESTANA.²—A small tree, from Cuba, with ovate, acute or elliptic, entire, rough leaves, 6 by 3

¹ *Boraginææ*, from the genus *borago*; derivation uncertain.

² *Cordia*, named by Plumier in honour of Cordius, a German botanist. *Sebestana*, having fruit like sebestans.

inches, and large cymes of bright scarlet flowers produced at the ends of the branches during January to March in abundance, succeeded by pure white fruits, $1\frac{1}{2}$ to $\frac{3}{4}$ inches. This very handsome plant is of easy culture in the open border: it may be reared from seeds sown while quite fresh.

HELIOTROPIUM PERUVIANUM.¹—A favourite garden undershrub, producing abundant fragrant flowers, varying from white to dark purple. It thrives at 5,000 feet, but can be grown well nearly to sea level by sowing at the end of the rainy season. At low altitudes it is advisable to treat the plant as an annual, sowing after the rainy season in pots, and transplanting when they have grown about five leaves. A position shaded after noon, and sufficient water given to keep the soil moist, is desirable. At altitudes of over 2,000 feet, it may be propagated by cuttings and grown with ordinary border treatment.

PARACARYUM MALABARICUM—*Kala-nissirdhi*.—Is a biennial herb which grows naturally on the bund Mahableshtar (about 4,000 feet altitude), has blue flowers nearly $\frac{1}{2}$ inch diameter in terminal racemes, and dark green radical leaves about 6 inches diameter, on stalks 1 to 12 inches long, and stem leaves which become smaller acute and ultimately sessile. Propagate by seeds to be gathered about February.

CONVOLVULACEÆ, *The Bindweed or Convolvulus Family.*

“ Beautiful are they, every one
Bright stars of earth, by which perchance we see
What Eden was—what Paradise might be.”

This group is easily distinguished by their twining habit and brilliant wheel-shaped flowers, of many enchanting shades, and alternate extipulate leaves, generally

¹ *Heliotropium*, turning to the sun. *Peruvianum*, from Peru.

heart-shaped, but often toothed and otherwise divided. Any good soil is suitable, and being plants of rapid growth, abundant water during the growing season is desirable. Many are annuals, and should be propagated by seed, but several of the finest are from South America, and do not seed in India, but are propagated by cuttings or shoots from the base. Not the least of the attractions of plants of this family are the Golden Tortoise Beetles which feed on the leaves—charming little beetles $\frac{1}{4}$ inch in length and breadth, and well described by the name. This family often has a milky juice, but rubber does not exist in it in practicable quantities.

ARGYREIA ARGENTIA¹—*Bistaruka, Kokayti, Samudra zogam*—and A. SPECIOSA²—*Samudra-shok*—grow rapidly in any ordinary soil. In gardens those climbers strangle the trees they are permitted to grow on; therefore they should be reserved for scraggy trees in open places. In both the leaves are large, heart-shaped, and with silvery hairs underneath, and the flowers rosy-purple. In the former the fruit is brown-yellow, firm, globular, pointed, and fully exposed; in the latter it is enclosed in the enlarged calyx.

ARGYREIA CUNEATA³—*Mahalungi*.—A native of the hilly tracts in the Deccan, climbing if in the shade, otherwise shrubby. It has short-stalked, elliptic or obovate, entire leaves, and deep, tubular, funnel-shaped, bright purple flowers. In a dry open part of the garden, with a deep, stony soil, this plant is very ornamental. If the seed is sown where the plant is wanted, and watered during the first rainy season, little more attention is required.

CONVOLVULUS ARVENSIS—*Hiranpag, Chandwell*—common in wheat fields in the Deccan, is a very beautiful plant, suitable for growing in suspended pots or baskets, where its rosy flowers, 2 inches in width, and

¹ *Argyrea*, from *argyros*, silvery.

² *Speciosa*, very beautiful.

³ *Cuneata*, wedge-shaped.

hastate leaves, 1 to 3 inches in length, may be fully displayed. If sown in September, the flowering season is during November to February. Sow a dozen seeds in a small, earthen, globular pot, called *gurha* or *murka*, which has very thin walls and does not require any hole in the bottom; when grown a few inches, hang up at the front of a verandah where there is little draught, and water when dry only.

EVOLVULUS ALSINOIDES—*Vishnoo-krant*.—This plant is pretty, and suitable for sowing on loose, gravelly soil where water is scarce. It is abundant throughout dry districts. The flower varies from white to deep blue, in size from $\frac{1}{4}$ to $\frac{1}{2}$ inch.

EXOGENIUM PURGA—the *Jalap plant*—is an elegant climber, having tuberous roots and flowers somewhat like *Ipomœa purpurea*. It thrives at 5,000 to 7,000 feet altitude, and yields a valuable drug in addition to nice flowers.

IPOMŒA AQUATICA¹—*Kulmi shah*, *Kooti kura*.—A showy plant growing on the banks of ponds and sending its long stems across the water, where it shows the direction of the prevailing wind. Its flowers are of a rich purple, and its leaves long, pointed, and with expanded points at the base. On damp soil it does not grow so fast, and flowers more freely. The shoots are eaten as a vegetable.

IPOMŒA BILOBA—*Goat's Foot Creeper*, *Marayada vel*, *Marja vel*, *Chagul Koon*.—A very beautiful plant, thriving on the seashore, where it creeps over rocks, lighting them up with its rosy purple flowers. Its leaves are deeply two-lobed, and resemble faintly the impression of a goat's foot. It is not of rapid growth, and in the garden a moist, exposed rockery suits it well. Cuttings or seeds may be planted with sandy soil in a new *murka* without a hole in the bottom, and hung up.

¹ *Ipomœa*, from its bindweed.

IPOMŒA BONA-NOX—*the Moon Flower, Munda-valli, Doodia kulmi*.—A climber with soft thorns on the stems, cordate, ovate, acute, entire, smooth leaves, 3 to 6 inches, and white circular flowers 3 to 4 inches in width, opening in the evening and fading next morning. The peduncle is club-shaped, and supports a membranous fruit enclosing four large seeds, white, red, or black in colour. The fruit is used as a vegetable.

IPOMŒA CAMPANULATA is a strong climber, living many years, and producing large bell-shaped flowers, pale rose at the mouth, deepening to dark crimson at the bottom, in great profusion during the cold season. This beautiful plant is indigenous to hilly tracts in Western India.

IPOMŒA CARNEA—from South America—with rosy flowers 4 inches in expansion. It is less of a climbing plant than many of its congeners, and may be treated as a shrub. Its rampant branches may be cut back to 6 inches after flowering. Easily propagated by cuttings.

IPOMŒA DIGITATA.—A twining, tuberous-rooted perennial, with five-partite leaves 4 inches by 5 inches, on stalks 4 inches long, and pink-purple cup-shaped flowers, $2\frac{1}{2}$ inches wide, succeeded by an egg-shaped capsule $\frac{1}{3}$ inch in diameter, enclosing four woolly seeds. It thrives especially in a moist climate.

IPOMŒA EDULIS—*Sweet Potato, Ritulla, Kappa-kelengu, Shakur-kund, Aloo*—is a trailing plant easily propagated by cuttings of the stem or the neck part of the tuber, planted at any time that ripe cuttings are procurable. The ground should be well manured and dug or ploughed, and laid out in ridges for irrigation. Cuttings, usually 18 inches long, are doubled up, and the middle portion inserted about 5 inches deep.

IPOMŒA RUBRO-CÆRULEA.¹—A species, with large blue or white flowers. Propagation by seed sown

¹ *Rubro-cærulea*, reddish-blue.

during June to August. When the seed of this species is sown, a small proportion of the flowers come white; the remainder of a brilliant blue. The mixture is very beautiful, but if it is desirable to separate the white from the blue-coloured plants, the seedlings should be examined while young, on the stem near to the first pair of leaves. If a bluish tint is apparent, the flowers will come blue; if a pale green colour is seen, white flowers will appear in due course. The same fact occurs in *Calotropis gigantea*, and doubtless in other plants which yield blue or white flowers.

IPOMŒA TERNATA resembles *I. horsfalliae*, but with white flowers 3 inch diameter at the mouth.

IPOMŒA TUBEROSA¹ is a climber of very rapid growth, with large digitate leaves of a dark green, and yellow flowers produced during the cold season.

IPOMŒA HORSFALLIÆ.—An evergreen twiner from the West Indies; its leaves are palmately divided into five lanceolate entire lobes with undulated margins. The flowers are of a rich glossy rose colour produced in dichotomous cymes on peduncles as long as the leaves. This plant is difficult to propagate in this country, and is not likely to become common. The method used in England is, cuttings of short side-shoots in a brisk bottom heat, but it may be grafted on the roots of an indigenous species.

IPOMŒA INSIGNIS has much the style of the above, but has smaller flowers, and seeds freely at Calcutta, therefore will soon become plentiful.

IPOMŒA LEARII is an old established favourite, with large dark blue flowers becoming reddish as they fade. To keep this plant in good order, young shoots, which come up near the root, should be taken off with some roots and planted several together in fresh soil at least

¹ *Tuberosa*, tuberous.

once yearly. These young plants will bloom a few months later, and the old ones may be removed as they become weak.

*IPOMŒA PHŒNICEA*¹ has bright-red flowers of the same size as the above and heart-shaped leaves. It is a pretty plant, but makes itself too common.

IPOMŒA PURPUREA—*Convolvulus major*.—The flowers of this annual climber are of every shade, from white to dark purple or crimson, and all are richly shaded. When grown over a bamboo trellised archway few plants are more showy. Seed may be sown in June in dry districts, and in wet districts later in proportion to the rainfall; in very moist low-lying places, it will be advisable to defer sowing until the beginning of December. Pots arranged by a tank so as to touch the water may be sown up to May, and will bloom nicely during the hot weather.

*IPOMŒA QUAMOCLIT*²—*Gumesh, Pushpa, Sita-ache-kes, Kamalata*.—A graceful climbing annual, attaining 6 feet in height, and having pinnate leaves, the pinnæ being thread-like, and bearing very profusely bright-red, white, or rarely yellow flowers, 1 inch in expansion. This is one of the premier class among pretty flowers, and is very easy of culture. The seed may be sown on rich friable soil as soon as the heavy rain is over. If sown in a basket with a high handle of open lattice work, it twines in and out and produces a beautiful object that may be taken indoors if necessary.

JACQUEMONTIA VIOLACEÆ.—A blue-coloured perennial convolvulus, suitable for covering a trellis or arbour, and thriving with ordinary border treatment. Propagate by seed and cuttings.

LAGENDREA MOLLISIMA.—A strong climber from the Canary Islands, which lives several years and develops a

¹ *Phænicea*, from the colour of the flower.

² *Quamoclit*, the Mexican name.



CONVOLVULUS MAJOR.

thick stem of a pale ash colour and marked by deep furrows. The leaves are cordate, smooth, and about 4 by 3 inches. The flowers are pale dun, abundant, of the size of a rupee, are frequented by bees. The plant grows without care in the alluvium on the banks of the river at Poona.

MERRIMIA TRIDENTATA (formerly *Ipomœa tridentata*)—*Morga, Sendari-Kalandi*.—An annual herb producing slender pendulous branches, 4 to 6 feet in length, bearing alternate leaves 1 inch by $\frac{1}{4}$ inch, having three teeth at the apex. As seen in Konkan jungles, growing downward from the top of a high bank, it resembles a girl's hair worn loose, and is remarkably graceful. Propagated by seed. Sow in the small, globular, thin water pots without a hole in the bottom, and hang in front of a verandah.

MERRIMIA VITIFOLIA¹ (formerly *Ipomœa vitifolia*)—*Navli*.—A climber having hairy, cordately, five-lobed leaves 2 to 6 inches in diameter, and clear primrose-yellow or sulphur-coloured flowers $2\frac{1}{2}$ inches in expansion, appearing during the cold season. This plant is abundant on the Western Ghats from Vingoria southwards, and at Marmagao thrives on rocky soil near the sea.

MINA LOBATA is slightly twining, and has deeply divided leaves and curved tubular inflated flowers, while fresh, bright red, but changing to pale yellow. It thrives specially in northern gardens, and on the hills.

OPERCULINA TURPETHRUM—*Tripute, Nisot, Teori, Shivadai, Tegada*.—An elegant perennial climber adapted for a moist climate. The leaves are variable, and the stem has membranous wings at the angles. The abundant white flowers are 2 inches diameter.

¹ *Vitifolia*, having leaves as in the vine.

PORANA PANICULATA¹—*The Snow Creeper*.—Few plants excite more admiration than this does when seen in flower during September and October. Its small pure white flowers are produced in such large silvery pubescent panicles that at a distance they resemble a bush covered with snow, and when cut for table make a charming ornament. The leaves are alternate, heart-shaped, and hoary, and in fruit the calyx develops three wings. The plant may be propagated by cuttings and layers, and thrives in dry districts with ordinary border treatment.

PORANA VOLUBILIS differs from the above chiefly in its smooth whitish green leaves, and its five-winged calyx.

PORANA MALABARICA has pure white flowers half an inch in width, and grows on the Western Ghats near Panchgany. It is doubtful whether this differs from *P. succmosa* (Roxb.).

RIVEA² HYPOCRATERIFORMIS—*Kalimiluta, Phang, Phandi, Mastigants*—"The Good-night Flower."—Is a climbing shrub of slow growth, living several years, thriving in a stony soil, and adapted for a part of the garden where water is scarce. Its flowers open at dusk, are pure white, fragrant, and the expanded part measures 2 inches in width or rather less than the length of the tubular part. Propagate by seeds sown near the root of a shrub with scanty foliage. The young leaves are used as a vegetable in Guzerat.

RIVEA ORNATA needs a moist climate, and has seven-flowered peduncles.

¹ *Porana*, said to be the vernacular word *purana*. *Paniculata*, having flowers in a repeatedly branched inflorescence developing from the base upward.

² *Rivea*, named after Auguste de la Rivea, a physician of Geneva.

SOLANACEÆ,¹ *The Potato Family.*

This is a large group of herbaceous plants with a few of the members soft-wooded shrubs. As all are of rapid growth, abundant manure, especially rich in potash and phosphoric acid, applied to a soil thoroughly tilled and kept moist, are necessary to produce well-developed plants. Increase is effected by seeds and by cuttings of tubers as in the potato, and seed retains vitality several years.

THE BRINJAL or AUBERGINE—*Egg plant, Wangi, Bengun*; generally known as *Solanum melongena*,² but now given *S. esculentum*.—This vegetable is in season during a great part of the year, and may be sown monthly from August to November on a seed bed of rich loamy soil, and when 4 inches high, may be planted in lines 18 to 24 inches apart, the same distance being preserved between in plants in the line. Abundant water should be given immediately after planting, and afterwards once weekly during dry weather. Liquid manure may be applied freely after young fruit has developed.

BRUNSFELSIA AMERICANA.³—A free-flowering shrub, having alternate, obovate, elliptic, acuminate, petiolate leaves, and funnel or salver-shaped flower having a long tube, yellow and odorous when fresh, but gradually becoming white. It is easily propagated from seed, which occasionally it produces freely.

BRUNSFELSIA LATIFOLIA.—A South American shrub bearing oval leaves and flowers the size of a rupee, which change from bluish to white and are produced at intervals throughout the year. Slight shade and a moist soil are the essentials in its cultivation.

¹ *Solanaceæ*, from the genus *solanum*, the old Latin name used by Pliny.

² *Melongena*, producing fruit like melons.

³ *Brunsfelsia*, named after Otto Brunfels, of Montz, who published in 1530 the first good figures of plants.

CAPSICUM FRUTESCENS and **C. GROSSUM**¹—*Cafree Mirich, Gach Mirich*.—The former is the common chillee, *mirchee*, and the latter a large variety of mild pungency. Sow in August and September on a carefully prepared seed-bed, and transplant when four inches high. Any fair garden soil enriched with manure is suitable. Irrigate when transplanted, and once in ten days afterwards until the fruit is nearly ripe. Manure having nitrogen 7·65 %, potash 17·20 %, and phosphoric acid 11·20 %, was found specially suitable for *Capsicums* by a French experimenter.

CAPSICUM MINIMUM²—*the Bird's-eye Chillee, Dhan Lunka Mirich*.—Grows freely when the seed has been dropped near a wall or where there is building refuse in the soil, with heavy supplies of water at long intervals. It is deep-rooting, and should be sown where required to grow.

CESTRUM AURANTIACUM.³—A large shrub, with alternate, entire, oval, undulated leaves having a sheen that appears to advantage on a table near a light. The flowers are tubular, 1 inch in length, of a bright, waxy, orange shade, and are produced in profusion during December.

CESTRUM ELEGANS.⁴—Resembling the above, but with purplish red flowers. Elegant border plants, easily propagated by cuttings.

CYPHOMANDRA BETACEA⁵—of North Granada and Peru—is a short-lived plant of tree-like habit, bearing a fruit like a small tomato, which is useful in pies; it grows rapidly at 2,000 feet altitude, but for practical culture requires 4,000 feet altitude in the latitude of Bombay. Soil and water as for the Tomato.

¹ *Capsicum*, from *kapto*, to bite, from the biting taste of the fruit. *Frutescens*, shrubby. *Grossum*, large.

² *Minimum*, smallest.

³ *Cestrum*, from *kestron*, an ancient Greek name. *Aurantiacum*, orange-coloured.

⁴ *Elegans*, elegant.

⁵ *Cyphomandra*, in allusion to the anthers being lumped together.

DATURA ARBOREA.—This grand shrub has elliptic oblong leaves with downy pubescence and tubular flowers 7 or 8 inches in length and about 4 inches wide at the mouth. It thrives at 4,000 feet altitude. At Mahableswar it is abundant on the roadside, and appears a special favourite of bees.

DATURA STRAMONIUM, D. METALOIDES, and other species are in this climate so weedy in habit that they need only to be mentioned here.

HYOSCYAMUS NIGER¹—*Henbane, Pala-dawa*—has been cultivated very successfully near Poona as a medicinal plant. Henbane may be sown at the beginning of September on a rich loamy soil heavily manured, thoroughly worked, and prepared for irrigation. In some instances, after the soil has been prepared, it is advisable to irrigate freely, then a day or so later the seed may be sown and another slight watering given. The seed will germinate in about ten days, and during the next twenty days the seedlings remain very small and apt to be destroyed by careless watering; afterwards the plants begin to grow rapidly and need careful attention to thinning. This must be done gradually until the plants are 18 inches apart in the lines. During this period of rapid growth, liberal supplies of liquid manure are desirable.

NICOTIANA AFFINIS.—An ornamental viscid annual, having abundant white flowers 2 inches in width and odorous at night. It should be sown thinly in a deep friable soil from August till October—the earlier date in dry, the latter in wet, districts—at 5,000 feet altitude. February to April is suitable for transplanting, which should be done with special care, if necessary, but it prolongs the flowering season by delaying blossom on the plants that have been moved.

¹ *Hyoscyamus*, from *hyos kyamos*, hog's bean, the ancient Greek name used by Dioscorides. *Niger*, black.

Several hybrids of *Affins* are now on the market, giving all colours possible.

NICOTIANA SANDURÆ is a popular hybrid with rose-coloured flower.

PETUNIA VIOLACEA¹ is of compact habit, and bears purplish-violet flowers about $\frac{1}{4}$ inch in expansion; and P. NYCTAGINIFLORA has white flowers about 2 inches in expansion and more flaccid than the above. Those are the originals of the very many double and brightly coloured garden forms which thrive well at from nearly 3,000 feet altitude at Bangalore to a much less height above the sea in northern districts. The seed is very minute, and for sowing it is advisable to prepare the seed pots a month in advance, so as to let seed of weeds which may be in the soil germinate, then to clear off the weeds. Make the surface smooth, mix the seed with fine sand to assist distribution, press gently into the soil, and place the pot in water until it is saturated, then place in a shady, well-drained position, protected from heavy rainfall. August is a good time to sow in southern latitudes or low altitudes; January and February on a hot bed at 7,000 feet altitude in Himalaya are suitable. When the seedlings are in the third leaf they may be pricked out into small pots, or 4 inches apart on a bed of good soil, and re-potted or transplanted as progress is made, and if in pots, stakes should be provided to sustain the rampant shoots. The original types make themselves at home at 2,000 feet altitude, and spring up self-sown.

PHYSALIS PERUVIANA—the *Cape Gooseberry*, *Tipari*.—Enjoys alluvial soil or a reddish loam with much leaf mould. Care must be taken that the plants are not weakened by overcrowding. When about 5 inches high, plant out 1 foot apart in lines 18 inches apart, and water during dry weather, enough to keep the soil moist, and

¹ *Petunia*, from *petun*, the Brazilian name for tobacco, in allusion to the affinity between this genus and the tobacco plant; *violacea*, violet coloured.

save fine specimens for seed by placing in a paper bag and hanging up where rats may not reach them.

POTATO—*Solanum tuberosum*, *Batata*.—As far as climate is concerned, the Potato thrives with the same conditions as wheat. At 7,000 feet altitude on Sikkim Himalaya it is a summer crop; from 2,000 to 5,000 feet altitude, in districts with light rainfall, it is planted in July; and at little above sea level it is planted in the beds of rivers in December. If planted on raised beds with good drainage channels, crops have been raised under a rainfall up to 60 inches; but, for successful cultivation, a rainfall of 15 inches, well distributed throughout the growing season, is sufficient, and not more than 30 inches is desirable. The cold season crop, getting heavy dew, takes $\frac{1}{2}$ inch of irrigation water per week for ten weeks, or if grown in a river bed, draws sufficient water by capillary attraction in addition to the dew. An open breezy position is preferable—if much sheltered, with moist air, the Potato will not go to rest, and the tubers of kidney varieties may be produced over a foot in length; and the tuber planted may resume growth instead of decaying and feeding the young plant. Regarding soil, a light loam is desirable: it must be rich without excess of salt, and soil having red colour from the presence of iron oxide produces the highest quality of tubers, near Mahableshwar and in the south-east of Scotland, and tenacious black soil is objectionable.

The seed-potato should have been well ripened and kept dry and cool: in hot climates, nets suspended from rafters are used when practicable. If small, the tuber may be planted entire; if large, cut lengthwise into several portions, and dip the cut surfaces in wood ash and dry before planting. Rows 2 feet apart, and the plants 15 inches apart in the row, is usually sufficient; more space is desirable for sorts under trial. About 10 cwt. of sets per acre are planted, and the sets may often be started into growth under cover before planting, with advantage, the sets being placed on the surface, with the manure

and the soil drawn from both sides to form a ridge. Repeated hoeing to keep the soil open, and to kill weeds, is necessary, and the soil being drawn towards the plants increases the production of tubers. Five tons per acre for dry cultivation tubers. An ordinary crop is 4 tons per acre for dry cultivation and 7 tons under irrigation. To raise new varieties suited to local conditions, see the chapter on Plant Breeding, page 122.

Very large potatoes are not desirable, unless as curiosities; 3 lb. 3 oz. is the record at present.

Potatoes thrive with—

Nitrogen,	-	-	-	8'30	per cent.
Potassium,	-	-	-	11'30	„
Phosphoric acid,	-	-	-	14'10	„
3½ oz. per square yard.					

DISEASES.

Ring Disease is often destructive in warm climates. On section of the tuber it shows a dark ring, more or less intense according with development, a short space inward from the skin, and black streaks in the stems and leaves, accompanied by wilting. It is caused by *bacillus solanacearum*, and may be prevented by examining the sets by cutting and avoiding all having a trace of disease.

Scab.—A disease which produces a rough, warty appearance on the skin. May be prevented by soaking the sets two hours in a mixture of 1 part formaline to 900 parts water.

SALPIGLOSSIS HYBRIDS are showy annuals which grow nicely if sown thinly in pots from August to October under a rainguard, and planted out when the monsoon is over, with precaution against root disturbance. It may be grown from sea level upwards, but is most successful at 4,000 feet altitude.

SOLANUM JASMINOIDES.—It is an elegant climber, thriving in a conservatory or on the northern face of a house in a rich but stony soil. Propagated by layers or cuttings.

SOLANUM MACRANTHUM.—A small tree from Venezuela, having large coarsely-lobed spiny leaves. Flowers, purple, changing to white, $2\frac{1}{2}$ inches wide. Fruit, a depressed berry, $2\frac{1}{2}$ by $1\frac{1}{2}$ inches. Rare. It grew nicely at Poona, planted by the roadside.

SOLANUM WENDLANDII, from Costa Rica, is a conservatory climber, of rapid growth in a moist atmosphere; with variable leaves, and abundant pale violet flowers. Increased by cuttings.

SOLANUM SEAFORTHIANUM is a good climber, fit for moist air; and **S. PENSILE**, from Brazil, is treated as the above.

SOLANUM COMMERSONII—*the Avenir or Swamp Potato*.— is a species of *Solanum* bearing tubers like those of the Potato, and recently carefully cultivated in France with a view to the development of its tuber-bearing habit. The weight of crop hitherto attained by it is far in advance of that given by the ordinary potato, and the new species being specially adapted for hot climates, there is a strong probability of its cultivation in India being successful.

SOLANUM MURICATUM, from Peru, produces fruit in abundance as large as turkeys' eggs, fleshy, sweet, and palatable, having the flavour of the melon with a touch of acidity. It grows well in the Canary Islands, and will grow in the Tropics at an altitude of 2,000 to 3,000 feet.

TOMATO — *Lycopersicum esculentum*, *Wail-wangi*, *Tamata*.— This esculent has secured popular favour by its intrinsic merits, and fortunately it grows nicely in warm climates; but in a dry atmosphere, with abundant water at the root, the finest fruit is obtained. The seed may be put down at any season, slight shade and abundant water being supplied during the hottest weather and protection from excessive wet secured. The seed should be sown thinly, and when 6 to 9 inches high may be transplanted safely if the soil be flooded and the roots of the plants pressed into the mud by the naked foot, as in

planting sugar-cane. To secure a long-continued supply, sowing should be repeated monthly. When the plants are neatly tied up to wires and kept at equal distance apart, the fruit grows equally, and may be gathered without loss; but reducing the foliage is not advisable under the influence of strong sunlight. The sort widely cultivated for market in India is expanded by hard, irregular ribs, which have been greatly reduced in select sorts, and, if permitted, cross-fertilisation causes the rapid loss of the cultivated character, which may be prevented by exclusion of the common sort. Lime and potash are important elements in manure for the Tomato, in addition to the essential phosphoric acid and nitrates, and the supply of common manure can scarcely be too liberal. Liquid manure is advisable after the fruit has set.

A disease called Black Spot, caused by the fungus *microsporium tomato*, is destructive to the Tomato. When this appears, it is advisable to heap a lot of rubbish on the plants and set fire to the whole.

SCROPHULARINE, *The Snapdragon Family.*

A group of herbaceous plants or shrubs having showy irregular flowers, and enjoying cool moist positions in Indian gardens. Propagation is generally easy by seeds and cuttings.

ALONSOA GRACILIS and A. WARSCEWICZI are scarlet-flowered herbs thriving at 3,000 to 7,000 feet altitude if sown when the rainy season is nearly over.

ANGELONIA SALICARIFOLIA.—A herbaceous plant, lance-shaped toothed leaves, and bearing racemes of purplish-lilac irregular flowers; it grows on the bank of a pond and remains almost constantly in bloom.

ANTIRRHINUM MAJUS¹—*Snapdragon*.—A showy herb thriving in cool districts of tropical countries. It may

¹ *Antirrhinum*, descriptive of the fruit, like a nose; *majus*, large.

be sown from the beginning of September till the end of November in pots of rich, loose soil, and planted out 6 inches apart in a flower bed as soon as large enough to be handled freely. It may be treated as annual in hot climates.

BROWALLIA ELATA.¹—A pretty annual, attaining about 1½ feet in height, and bearing deep blue or white flowers about ½ inch in expansion. If sown during September to December on a bed of rich friable soil kept *very* moist, it blooms about two months after sowing.

CALCEOLARIA HYBRIDS.—The large-flowered herbaceous varieties are very showy plants, requiring the protection of a conservatory and altitude 4,000 to 7,000 feet, in India. The seed may be sown in pots during August to October, and the seedlings, being pricked out into boxes, should be grown with abundant air, slight shade, and regular watering until large enough to transfer to 8-inch pots, in which they blossom during June to August. The soil necessary is turfy loam, with abundant sand or broken charcoal, and with the drainage carefully arranged.

CALCEOLARIA RUGOSA.—The small yellow-flowered species used for garden bedding is similar in the general treatment required, but may be pricked out in the open border. It is occasionally found wild as a garden escape at 4,000 feet altitude.

DIASCIA BARBERÆ.—A South African dwarf annual with rosy-pink flowers; charming on a border with northern exposure from 3,000 feet altitude upward. Sow during August to October, where wanted to bloom, and give water freely.

DIGITALIS PURPUREA.—The Foxglove proves difficult within our bounds.

¹ *Browallia*, in honour of John Browall, Bishop of Abo, a defender of Linnæus' system; *elata*, tall.

MAURANDIA¹ **BARCLAIANA**.—A delicate climber, elegant on a trellis about 6 feet in height. In dry districts the seed may be sown in July; in districts with heavy rain sowing must be deferred until the close of the monsoon. The leaves are cordate, acuminate, or hastate, and the flowers solitary axillary, pale in the tube, and with violet and purple shades on the lobes.

MAURANDIA SCANDENS.—A climber having softly hairy leaves variable in outline, opposite towards the base of the plant but alternate upwards. The plant climbs by the stalk of the leaf, clasping any available support. If the seed be sown when the heavy part of the rainfall is over, and the plants grown in rich soil with a partly shaded exposure, the purple violet flowers are freely produced during the cold season.

MYOSOTIS VARIETIES—*Forget-me-Not*.—May be grown from 4,000 feet altitude upward, by sowing during September and October on rich border, freely watered and shaded on the south.

PENTSTEMON.—Cross-breeds of this showy herb bloom at 4,000 to 6,000 feet altitude in Southern India or Ceylon if sown when the S.W. monsoon is nearly over and carefully grown on a rich border shaded during high sun and watered freely, but the next monsoon cuts short the flowering period, except in favoured localities.

REHMANNIA CHINENSIS—*Angulata*.—Reddish-crimson.

RUSSELIA JUNCEA² is a very ornamental plant; its long rush-like stems with few leaves and bearing racemes of bright red tubular flowers 1 inch in length are freely produced almost through the year when planted near water. The most floriferous are at 2,000 to 3,000 feet altitude with full exposure to the sun.

¹ *Maurandia*, named after Dr. Maurandy, once Professor of Botany at Carthage.

² *Russelia*, named after Alexander Russel, author of a *Natural History of Aleppo*; *junceae*, like a reed.

RUSSELIA FLORIBUNDA¹ has sessile, orbicular leaves deeply cordate at the base, and crowded spikes of tubular red flowers, and thrives as the above.

SOPUBIA DELPHINIFOLIA—*Dudhali, Kulthi*.—An elegant erect annual, common in wet places, bearing rosy flowers 1 inch in width, and opposite, pinnatifid leaves with linear divisions. Could, by selection of the finest coloured flowers, be easily made a useful garden plant. It should be sown thinly in pots having a saucer of water beneath.

TORENIA ASIATICA,² a dwarf herb with ovate-cordate or lanceolate serrated leaves having short petioles and wide-mouthed flowers, of many shades of blue and violet, produced continuously for several months. It makes a pretty basket plant in a moist conservatory, may be propagated from cuttings very easily, and is a convenient subject for the study of the ovule.

TORENIA CONCOLOR³ has pale purple or lilac flowers.

TORENIA FOURNIERI.—An elegant species, distinguished from *T. asiatica* by the absence of a long tooth on the filament.

LENTIBULARIACEÆ.

Utricularia of this order are very interesting in the garden wherever water enough is available, when they catch small organisms with bladder-like appendages.

UTRICULATA RETICULATA has a bluish-purple corolla $\frac{3}{4}$ inch or more across on twining scapes, and linear, oblong, obtuse leaves $\frac{1}{2}$ to $\frac{3}{4}$ inch, which disappear early. Ten species are described in the *Flora of the Pres. Bombay* (T. Cooke).

¹ *Floribunda*, having many flowers.

² *Torenia*, commemorative of Olef Toren, who discovered *Torena Asiatica* in China; *asiatica*, from Asia.

³ *Concolor*, of one colour.

GESNERACEÆ,¹ *The Gesnera Family.*

A small group of herbaceous plants having short underground stems (rhizomes) and giving brilliant flowers or richly-coloured foliage. They thrive in shallow pots with a compost of two parts leaf-mould, one part good loam, and one part sharp sand or broken bricks, with regular watering from May till October and partial or complete rest during the interval. Roots of this family may be imported safely by post.

ACHIMENES.²—The roots (rhizomes) start into growth during May. As soon as the slightest indication of growth is seen, the dried up soil may be moistened and the roots shifted to fresh compost, planting about a dozen roots in a shallow pot, and as the growth increases let more water be given. When up about 6 inches and the soil full of roots, give weak liquid manure once a week; when the bloom is past, reduce the water and lay the pots in shade with a covering of straw. Propagate by dividing the rhizomes in May or by planting well-grown leaves in sand during September and October.

ACHIMENES TUBIFLORA is described by Furminger:—“The stems lie prostrate on the ground, bearing at their extremities whorls of woolly lanceolate leaves, 5 inches long; it produces in April clusters of heavy, but not disagreeably scented pale primrose coloured flowers, of tubular form, the tube 3 inches long and then expanding so as to resemble a white petunia. The root is tuberous and might easily be mistaken for a large potato.” It thrives well on the shady side of a tree in rich loam kept moist during the rainy and cold season, and may be increased by dividing the roots, which must be protected from the rats.

¹ *Gesneraceæ*, from the genus *gesnera*, named in honour of Conrad Gesner, of Zurich, a famous botanist, 1516-1565.

² *Achimenes*, from *cheimaino*, to suffer from cold, in allusion to the general tenderness of the species.



SUTTON'S SUPERB ACHIMENE.
(By favour of Messrs Sutton, Reading.)



CYRTODERA FULGIDA

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CYRTODERA FULGIDA.—A very fine herbaceous plant, having richly marbled hairy leaves which spread on the surface, and bright crimson flowers. This plant needs the protection of a moist frame and a sandy soil enriched with plenty of leaf-mould. It is propagated by division as the slowly creeping stem forms roots at intervals.

EPISCIA TESSELATA.—An herbaceous plant with subcordate, petiolate leaves having a very rough uneven surface, of a beautiful dark olive green of a bronzy shade above and vinous beneath. It is a common plant in conservatories, where it appears to enjoy the moist equable atmosphere.

GLOXINIA is the popular name of varieties of *Ginningia speciosa*, warm-temperate plants, specially adapted for the conservatory at 4,000 to 7,000 feet altitude, but in hot climates short-lived, although occasionally rewarding cultivators with their rich beauty. Roots imported in November, if started into growth in the cool, moist atmosphere which Bombay enjoys during winter, will bloom nicely in February if kept in shade, but will be exhausted when the blossom is over. At the higher altitudes, if potted in a mixture of leaf-mould and sand and started into growth during April, flowers appear in July, and by October the plant dries up. Increase by cuttings of leaves inserted during July to October in sand under a bell-glass.

GLOXINIA MACULATA.—A strong-growing species having the radical leaves heart-shaped, 6 by 4 inches, smooth and green above and reddish beneath, and the cauline leaves ovate. The stem is terminated by a raceme of large pale blue widely tubular flowers. In the Deccan this species grows well on a bank of rich soil regularly watered during the rainy season, and flowers profusely during October and November.

NÆGELIA ZEBRINA.¹—Near Poona this plant is one of the richest ornaments the gardens possess. During May

¹ *Nægelia*, after Carl Nægeli, a German botanist; *zebrina*, striped.

the roots start into growth, and should be planted separately in pots with the compost given under *Gesneraceae*. A pot 8 inches in width and depth is fit for one root. Water gently at first, but when the pot is covered with leaves give one thorough watering daily and keep the plant in slight shade and in a place free from dust. When the foliage is well developed it gives the richest velvety tints conceivable, and is followed by a raceme of bright flame-coloured flowers. On a slightly shaded and sheltered raised bed with the plants put out 18 inches apart a beautiful effect is produced. To propagate slowly, separate the rhizomes at potting time; for rapid propagation, plant cuttings of the leaves, taking a part where two large veins meet for the base of the cutting, during September and October.

SAINTPAULIA IONANTHA.—A small herbaceous plant from Central Africa, has oval or roundish leaves about 2 inches in width on short stalks and violet-coloured flowers produced freely, almost throughout the year. It thrives in a moist conservatory and on rockwork, in moist air and light shade, and may be propagated by seed or by leaves inserted in sand under a bell-glass.

STREPTOCARPUS.—*Cape Primrose.*—A genus of remarkable South African or Madagascar herbaceous plants, often with a thick tuberous root and a solitary leaf (an enlarged cotyledon or seed-leaf) which spreads on the ground and grows 2 to 3 feet in length, but more frequently in gardens, as figured above by favour of Messrs. Sutton & Sons, Reading. They grow nicely in pots on the northern side of a house or tree in districts having light rainfall, and especially from 1,000 to 5,000 feet altitude.

BIGNONIACEÆ,¹ *The Trumpet Flowers.*

A small family, including several very fine garden garden climbers, shrubs, and trees, having large seed

¹ *Bignoniaceæ*, from the genus *Bignonia*, so called by Tournefort, in compliment to the Abbé Bignon, librarian to Louis IV.



STREPTOCARPUS (GREENHOUSE PERENNIAL).

pod, with a central vertical partition, and winged seeds, usually flat. Large white or yellow flowers prevail.

Many of the plants are adapted for a dry, stony soil, and need little more water than nature provides in the dry districts of India, but a few large climbers, which are useful for covering walls and thrive with full sun exposure, need regular watering. Propagation is effected by seeds or cuttings, and especially root cuttings. Among climbers the following are very fine:—

BIGNONIA ARGYREO-VIOLASCENS.¹—In the Deccan this proves a grand climber. While young it bears simple, ovate leaves of a rich violet colour, gradually changing to pale green with white veins. As the plant develops, the peculiar colours disappear and the leaves become pinnate with two ovate leaflets, and the midrib is produced into a short, trifid, hooked clasp which enables the plant to lay hold of a rough wall exactly as in *Bignonia unguis-cati*, of which this is probably a variety. The flowers are orange-coloured and produced in great profusion in March, rarely yielding fruit, which measures 4 feet by $\frac{5}{8}$ inch by $\frac{1}{8}$ inch.

BIGNONIA UNGUIS-CATI—*the Cat's Claw climber*.—An elegant climber, which clings to stone-work by small hooked tendrils. Flowers bright yellow, produced in great profusion for a short time during the hot weather. This plant set against a house lends a charm to some buildings. For planting, a deep hole should be prepared and filled with good soil, decayed garden sweepings, and stones in equal parts: in a soil of this kind the plant will grow even if the exposure is southerly.

BIGNONIA INCARNATA.—A climbing shrub having opposite leaves of two oval or elliptical smooth, shining, entire leaflets, 4 inches by 2 inches; a simple tendril, 5 inches in length, represents the third leaflet. The leaves, while young, are bright green; when old, deep green and leathery. The calyx, cup-shaped, with 5 or more points;

¹ *Argyreo-violascens*, silvery and violet coloured.

the corolla, funnel-shaped, $2\frac{1}{2}$ inches in length and half as wide at the 5-lobed mouth; pale lilac, with veins of deep purple; inside the tube white. It blossoms during the hot season, and thrives in any good soil with moderate watering and northern exposure. Propagate by layers.

BIGNOLIA REGALIS.—A handsome climber, with opposite, elliptic, lanceolate leaves. The flowers are of a bright yellow and red colour.

BIGNONIA MAGNIFICA.¹—A woody climber of rapid growth, having abundant flowers during September to December $3\frac{1}{2}$ inches across, ranging from delicate mauve to rich purplish-crimson, relieved by a conspicuous throat of light primrose colour. The first leaves on a branch are simple and the succeeding leaves are compound, of two obovate leaflets attaining 4 inches by $2\frac{1}{2}$ inches with the *rachis* (the midrib of a compound leaf) produced as a simple tendril 6 inches in length. It grows well on the northern side of a house in a rich loamy soil. Increased by layers.

OROXYLUM INDICUM—*Iaitu, Shyona, Vanga Marum, Pampena*.—A small tree of rapid growth, native of moist districts such as Assam Valley, producing compound leaves of great size, large white flowers, and pods about 2 feet long by 4 inches broad. It needs a rich soil and occasional watering.

PARMENTIERA CERIFERA—*the Candle Tree of Panama*—was many years in the Club Compound at Poona, bearing long straight branches, apparently alternate leaves of three leaflets and a winged petiole with a spine at the base and pendulous fruit like a bunch of candles. It requires a strong soil and little water. Propagated by cuttings.

PYROSTEGIA IGNEA—formerly *Bignonia venusta*.—At Poona and other places with similar climate this is an ornamental climber of the first-class. In a loamy soil,

¹ *Magnifica*, magnificent.

watered occasionally, it climbs to the top of high trees, and during the cold season bears grand terminal corymbs of orange-crimson trumpet-shaped flowers $2\frac{1}{2}$ inches in length. The leaves are normally of three leaflets, but the middle one is seldom developed and is often transformed into a long tendril having three hooks at the end. The manner in which this tendril contracts after it has laid hold of some object is very interesting. The leaflets are ovate-pointed, smooth on the surface, and entire at the margin. It is easily propagated by layering and by cuttings in a frame.

SPATHODEA CAMPANULATA.—It is a small tree with a straight, slender stem about 15 feet in height, having a few short branches bearing a crown of large pinnate leaves having lanceolate, petiolulate, entire leaflets, and terminating in erect racemes of orange-scarlet bell-shaped flowers 3 inches by $2\frac{1}{4}$ inches, which appear from September to November. It thrives with ordinary garden treatment both in wet and dry districts.

CRESCENTIA CAJETE¹—the *Calabash Tree of South America*—is a small tree of irregular growth, bearing oblong wedge-shaped, entire shining leaves and flowers of a mixture of green, purple, red, and yellow; produced on the stem and older branches and succeeded by fruit outwardly resembling a *pamilo*, but having a hard rind, used in South America for culinary purposes. A useful member of the shrubbery, and is propagated by seed or layering.

DOLICHANDRONE FALCATA—*Netasing, Marsingi, Mershing, Morshing*.—A small tree suited for a rocky trap soil; its flowers are pure white, very graceful, but short-lived.

JACARANDA² OVALIFOLIA.—A graceful shrub having opposite, exstipulate, twice pinnate leaves, each pinna

¹ *Crescentia*, named after Pietro Crescenzi, an Italian writer on agriculture; *cajete*, probably a vernacular name.

² *Jacaranda*, the name of one of the species in Brazil.

consisting of ten to twenty-eight pairs of trapezoid oval oblong, shortly, pointed, downy leaflets, and producing terminal leafless erect pyramidical panicles of silky blue flowers. It thrives with conservatory treatment at 2,000, and in the open border from 3,000 feet altitude; and, while young, is an excellent table plant. It may be reared from seed or cuttings. This ornamental tree is a native of Brazil; it flowered at Lahore in 1899, and gives tubular violet-blue flowers on large terminal panicles.

KIGELIA PINNATA.—A small tree having opposite, pinnate leaves of about eight very stiff obovate, elliptic leaflets, and in moist districts producing long pendulous racemes of large, dull, liver-coloured flowers, during the hot season. It grows very rapidly if planted on the margin of a tank in rich soil, and is propagated by seed. Tropical Africa. The pendulous flower stalk occasionally produces flowers.

MILLINGTONIA HORTENSIS¹—*Cowla Nim.*—A very tall handsome tree, producing trumpet-shaped, white odorous flowers during November to January; very hardy and ornamental as a road-side tree. It may be transplanted during November although of very large size, and the strong shoots which appear at the base may be taken off and planted as cuttings with safety.

RADERMACHERA PENTANDRA.—From Yunnan China, 5,000 feet altitude; produces very large two to three pinnate leaves 2 to 3 feet in length, each leaflet 5 inches by 12 inches, and numerous white flowers as large as *Beaumontia*. Would be an acquisition in gardens.

TECOMA JASMINOIDES.²—A very graceful climber, with opposite compound leaves, cut or not; it requires a deep stony soil.

¹ *Millingtonia*, after Thomas Millington, an English botanist of the eighteenth century; *hortensis*, of gardens.

² *Tecoma*, an abridgment of the Mexican name Tecomaxochit; *jasmínoides*, like *jasminum*.

TECOMA STANS.—A graceful hardy shrub with yellow flowers; is specially useful as a screen.

TECOMA RADICANS.—A shrubby plant with red trumpet-shaped flowers; it is apt to produce long trailing branches when in a rich soil, and one of its forms clings to walls by roots if the climate be moist.

TECOMELLA UNDULATA—*Ruhta rohida*, *Lehedo*.—A small tree having simple entire, opposite leaves with waving margins and orange-yellow bell-shaped flowers $1\frac{1}{2}$ inches to $2\frac{1}{2}$ inches long, with linear capsule 8 inches by $\frac{3}{4}$ inch. It thrives in the dry parts of India.

PEDALINÆ,¹ *The Sesamum Family.*

Includes *Sesamum indicum*, Gingelly, *Til*, or *Howra Til*, a very important oil-seed. If sown near the beginning of the rainy season, the plant is interesting and ornamental when in flower about September.

CERATOTHECA TRILOBA.²—An annual from Natal having purple or lilac flowers resembling the *Sesamum*. Grows with border treatment in dry districts.

MARTYNIA DIANDRA.³—An annual plant bearing large, opposite, stalked, cordate leaves, with clammy glands, and richly-coloured flowers resembling the fox-glove, succeeded by horny fruits provided with a pair of sharp recurved claws, evidently intended to assist in the distribution of the seed. The plant is called *Vichoo-acha-jhar*, and the story goes that if a person be stung by a scorpion, one of those fruits ground to a paste and applied to the wound will cure it. This is correct,

¹ *Pedalinæ*, from the genus *pedalum*, from *pedalion*, a rudder, in reference to the dilated angles of the fruit.

² *Ceratotherca*, referring to the horned capsule (the fruit). *Triloba*, three-lobed (leaves).

³ *Martynia*, after John Martyn, F.R.S., 1699-1768, once Professor of Botany at Cambridge. *Diandra*, having two stamens.

because the nut is so hard that the pain will subside when the paste is ready.

MARTYNIA PROBOSCIDEA, with curving horns 3 inches in length on the fruit, grows with little trouble if sown during the rainy season at 2,000 to 6,000 ft. altitude. The unripe fruit is used in pickle.

ACANTHACEÆ, *The Acanthus Family.*

A family including many beautiful shrubs, a few choice climbers, *Thunbergia*, and some useful medicinal plants, *Karayet*.

All this family enjoy a soil well enriched with leaf mould, and the shrubby members are much improved by shade and moisture. As the range of leaf colour extends from the almost white *Fittonia argyroneura*, and the grey *Eranthemum pallidum*, to the darker purple of *Graptophyllum hortensis*, many fine colour effects can be made with the foliage of this family. All are easily propagated by cuttings. The above remarks apply to all the following:—

ADHATODA VASICA¹—*Adulsa*.—A shrub common near villages in moist districts, about 2,000 to 3,000 feet altitude, in the latitude of Bombay. It is not usually a garden plant, but is useful as a fence, and employed in abortion to expel the dead foetus, and in coughs and colds. Propagated easily by cuttings or seeds.

APHELANDRA CRISTATA.²

ASYSTASIA COROMANDELIANA.—A pretty under-shrub of loose spreading habit, and flowering from August to December. The flowers change from purple to yellow, are 1 inch in expansion, and are arranged on

¹ *Adhatoda*, from a vernacular name. *Vasica*, pertaining to the *vasa*.

² *Aphelandra*, from *appelos*, simple, and *aner*, a male, the anthers being one-celled.

one side of the spike. It is a native of hills in the Deccan, and thrives with ordinary border treatment.

BARLERIA CRISTATA¹ Varieties—*Gokru*—are shrubs with beautiful fugaceous flowers, in colour pure white, rose, and blue.

BARLERIA GIBSONII.—A fine species, at home on the Western Ghats, but rare. Makes a showy conservatory plant, and thrives especially at 3,000 feet altitude.

BELOPERONE AURANTICA.—A very handsome under-shrub, producing terminal erect spikes of pale golden flowers. It thrives with moist shade, and needs a rich soil and to be pruned after the bloom is passed. It is easily propagated by cuttings.

CROSSANDRA UNDULÆFOLIA²—*Abholi*, *Praya-darsha*.—A small shrub producing orange-coloured flowers $\frac{3}{4}$ inch in expansion, on a one-sided spike. It is much grown by the Goanese, and thrives on moist soil without difficulty.

DAEDALACANTHUS ROSEUS—*Dasamuli*.—A small shrub with dark green opposite leaves and blue flowers in terminal spikes. It grows in the shrubbery with little care, and medicinal properties are ascribed to it (*Pharm. Ind.*, III. 45).

ERANTHEMUM PALATIFERUM,³ has pale-grey marbled foliage.

FITTONIA ARGYRONEURA.⁴—A creeping under-shrub, with leaves veined with pure white. Should be planted out in the conservatory with much leaf mould.

¹ *Barleria*, named after J. Barrelier, a French botanist. *Cristata*, crested.

² *Crossandra*, from *krossos*, a fringe, and *andross*, an anther, in reference to the anthers being fringed.

³ *Eranthemum*, from *eran*, to love, and *anthemon*, a flower.

⁴ *Fittonia*, in honour of E. and S. M. Fitton, authors of *Conversations in Botany*.

FITTONIA PEARCEL.—Like the above, but with copper-coloured veins; treatment similar.

GRAPTOPHYLLUM PICTUM.¹—Green, with bright yellow markings.

GRAPTOPHYLLUM HORTENSIS.²—Dark bronze-coloured foliage.

GYMDOSTACHUM CEYLONICUM.—A dwarf, slightly-creeping plant, with leaves spreading horizontally and bearing milk-white stains on a dark-green ground. The flowers have a white corolla tipped with green and yellow. With slight shade and regular watering it forms a pleasing contrast with other coloured foliage, and is easily increased by cuttings.

HEMIGRAPHIS COLORATA.—A prostrate plant, having opposite, purplish-bronze, smooth, entire leaves, about 4 by 2½ inches, and producing during the cold season small, white, irregular, bracteate flowers. Ornamental, from distinct colour, on moist rockwork. Propagate by cuttings.

JUSTICIA GENDARUSSA³—*Tew, Jugat mudun.*—A favourite edging for a shady position. Its leaves, dried and powdered, serve to protect books from the book-worm.

RHINACANTHUS COMMUNIS—*Gaji-karni.*—An undershrub producing abundant, pretty, white flowers, having one lobe of the corolla turned up like a horn. Ordinary border treatment suffices.

RUELLIA BAIKIEI.⁴—An undershrub producing racemes of trumpet-shaped scarlet flowers from September to April (*Trop. Af. Bot. Mag.*, 5161).

¹ *Graptophyllum*, from *grapto*, to write, and *phyllum*, a leaf; referring to the markings on the leaves.

² *Hortensis*, of gardens.

³ *Justicia*, after J. Justice, a Scotch horticulturalist. *Gendarussa*, should be *Ghundarusa*, implying having juice of a disagreeable smell.

⁴ *Ruellia*, in honour of John Ruelle of Soissons.

SANCHEZIA NOBILIS.¹—A shrub from Eucador, having large, opposite leaves with bright yellow veins. Moist air, a rich soil, and slight shade, suit it. Propagate by cuttings.

STROBILANTHES DYERIANUS.—An ornamental undershrub, with opposite, entire, sessile leaves, about 6 in. by 3 in.; the ribs are green, and the intercostal space is at first ruby, but later becomes whitish. It thrives in a hot and moist climate, and is easy to propagate by cuttings.

THUNBERGIA ERECTA—formerly *Meyenia erecta*—with purple or white flowers, is a shrub of a hardy character, thriving with full sunshine.

THUNBERGIA² **GRANDIFLORA**—*Mil-luta*.—An extensive climber with large lilac or white flowers, one variety with smooth leaves blossoms while of small size; the hairy-leaved sort is of excessively vigorous growth, and blooms when mature. Propagated by cuttings or suckers.

THUNBERGIA MYSORENSE.—An elegant climbing shrub giving showy flower coloured yellow and maroon during the cold season. In the Deccan it thrives on the northern side of a house, but is specially at home at 4,000 feet altitude.

THUNBERGIA KIRKII.—An under-shrub with leaves elliptical, with a large tooth-like expansion on each side and violet-blue thimble-shaped flowers in pairs.

THUNBERGIA FRAGRANS.—A small climber with opposite, ovate or oblong acute, stalked leaves and pure white fragrant but evanescent flowers 3 inches in expansion. Abundant on the Western Ghats, 3,000 feet altitude, If sown in the garden at the base of a shrub it thrives and is pleasing.

¹ *Sanchezia*, in honour of Josef Sanchez of Cadiz.

² *Thunbergia*, named after C. P. Thunberg, of Upsala, 1748-1822.

THUNBERGIA ALATA resembles the above, except in having a deep yellow flower with a very deep purple spot in the centre; it becomes a weed in gardens.

VERBENACEÆ,¹ *The Verbena Family.*

This group of plants includes a few valuable timber trees (*Teak, Shevan*); some very ornamental shrubs (*Clerodendron, Duranta*); and a few choice herbs (*Verbena*).

The trees thrive on a reddish loam with heavy rainfall or irrigation during the rainy season. The shrubs also thrive on reddish loam, but require a liberal supply of vegetable matter in the soil, and the herbaceous plants still more vegetable matter in the form of well-decomposed leaf mould.

Propagation is effected by cuttings and seeds. The seeds of trees in this family as a rule keep in a good order several years, and take long to germinate. It is advisable to bury them in a moist pit with leaves from the time of gathering till the beginning of the first or second monsoon, or mix with fresh cowdung and leave in a moist place a few months; but the herbaceous species will usually germinate quickly from seed just ripened.

CITHAREXYLON SUBSERRATUM² as a garden tree is of very rapid growth on a sandy loam soil with free supply of water, and is easily propagated by cuttings.

CLERODENDRON.³—Many species of this genus are very handsome flowering shrubs, of easy culture in ordinary good garden soil, regularly watered and slightly shaded.

¹ *Verbenacæ*, from *verbena*, an old Latin name used by Virgil and Pliny.

² *Citharexylon*, fiddle-wood. *Subserratum*, slightly saw-toothed.

³ *Clerodendron*, from *kleros*, chance, and *dendron*, a tree, said to be from its uncertain medicinal properties.

CLERODENDRON ACULEATA.—With small, sweet-scented flowers and short thorns, a suitable plant for fences or toparian work.

CLERODENDRON BUCHANANII—*Bu-gynee-ne* (Burm.), *Clerodendron fallax* of gardens.—Flowers brilliant scarlet; propagate by seeds. A much valued soft-wooded shrub of slow growth. A rich sandy loam with shade at noon and regular watering, enough to keep the soil moist, suits it. Cuttings root freely in sandy soil in a propagating frame, but seed sown as soon as it is ripe is a better means of increasing the stock.

CLERODENDRON EMINENSE.—From Madagascar: has pure white flowers produced in terminal corymbs and entire, oblong, smooth shining leaves. A very useful shrubby species, thriving in the Deccan in fair soil, when established, without irrigation.

CLERODENDRON FRAGRANS.—Flowers double, very fragrant, leaves foetid when bruised; propagate by suckers. Becomes a weed in good soil.

CLERODENDRON INERNE—*Vanajai* (*The Forest Jasmine*).—This spreading shrub has many vernacular names (given at the foot of the page). Is well known on eastern shores from its medicinal properties, which (*Pharm. Ind.*, III., 77) resemble those of Chiretta; the dried leaves in infusion and tincture, and the juice of the fresh plant in $\frac{1}{2}$ oz. doses, have a reputation as febrifuge and alterative in scrofulous and allied affections. This shrub grows on the banks of salt-water creeks in the Concan, and the bright green of its sprawling branches on low banks that have little other vegetation, lend a charm to a desolate region. It also grows inland, and in the Municipal

Vernacular names of *Clerodendron inerne*—*Naitakkili* (Canarese), *Sangkupi*, *Choti-arni* (Hind), *Isandhari* (Deccan), *Shen-gan-kupi* (Tamil), *Pishmika*, *Utichettu* (Telugu), *Banjoi* (Bengali), *Koivel*, *Vanajoi*, *Lahan-khari-narvel* (Marathi), *Waul-bu-raenda* (Ceylon), *Pinley-kyong-ben*.

Garden, Karachi, a gateway is clothed in its deep green foliage, lit up by white flowers $\frac{3}{4}$ inch in diameter. Propagate from seed or cuttings.

CLERODENDRON MACROSIPHON (of Zanzibar) has long tubed white opposite flowers with purple anthers and lobed leaves of lance-formed outline.

CLERODENDRON PANICULATUM (of East Persia) has cordate leaves and red flowers with long recurved stamens.

CLERODENDRON JACKIANUM—*Gan-yan-ta-po* (Burm.), formerly *C. nutans*.—Flowers white, drooping; propagate by suckers. The beauty of the drooping Clerodendron, about 6 feet in height, with its dark green foliage and fine white flowers, is remarkable when well grown in a moist atmosphere with slight shade—it is better at 2,000 feet altitude than elsewhere—but even at sea level is worth a lot of trouble. It is particularly good as a pot plant with the shoots from the base frequently removed for propagation and a saucer under the pot to prevent injury from drought.

CLERODENDRON PHLOMOIDES—*Airan, Takle*—has oval, rhomboid, irregularly toothed leaves of a pale green colour, and produces abundant pale yellow or white fragrant flowers in July. It is a useful shrub, very hardy, and serves as a stock on which to graft *C. Thomsonae* or *C. Buchananii*.

CLERODENDRON SIPHONANTHUS—*Arnah, Arni*.—With tubular curved flowers about 4 inches in length in large panicles, is a very elegant plant of rapid growth in a rich garden soil irrigated occasionally.

CLERODENDRON THOMSONÆ.—Short climber; corolla scarlet with white calyx. Propagate by cuttings in frame. This charming climber especially needs a moist atmosphere. A very fine specimen grew against the south side of a house on the seashore at Marmagoa, protected from strong sunshine.



DURANTA PLUMIERI.

CONGEA AZUREA.—A tomentose climbing shrub from East Bengal, having showy pink flowers 6 to 9 inches in a three-leaved involucre. It thrives in a moist atmosphere, and at Madras becomes "one blaze of colour with flowering branches one foot in length" (*Agri.-Horti. Soc. Report*). It is difficult to propagate, and is rare in gardens; layers root tardily, and cuttings in pots with clean sand protected by a bell-glass and placed in a shaded frame root fairly.

DURANTA¹ PLUMIERI.—A shrub from tropical America, producing abundant flowers in drooping racemes and of various shades of lilac, succeeded by yellow berries. As a fence plant in a deep friable soil at 2,000 to 4,000 feet altitude, this plant is excellent. It is easily propagated by cuttings, and bears clipping well; to ensure germination the seed requires to be buried in the ground a year before it is sown. There are several distinct varieties, differing in habit and growth; and **D. ELLISII**, a pure white-flowered variety, is valued for wreaths and bouquets.

GMELINA ARBOREA²—*Sevan, Shewan, Gumar, Gumar, Goomadee*.—The seed of this tree may be treated as detailed for Teak, but large cuttings planted in August or September root freely.

GMELINA ASIATICA—*Shieri-gumudu*.—A hardy shrub, having entire or three-lobed opposite leaves $\frac{1}{2}$ to $1\frac{1}{2}$ inches in length when mature, pale green beneath from a coat of minute glands.

GMELINA HYSTRIX.³—A spinous shrub, scandent if shaded, having smooth, entire, elliptical leaves 3 by $1\frac{1}{2}$ inches with scattered glands, and yellow flowers produced in long pendulous clusters having bracts with purple veining.

¹ *Duranta*, in honour of Castor Durantes, a botanist, who died in 1590.

² *Gmelina*, in honour of Gottlieb Gmelin, a German naturalist, 1743-1774. *Arborea*, tree-like.

³ *Hystrix*, a porcupine, in allusion to its spines.

HOLMSKOLDIA SANGUINEA—*Kul-tolio*.—A free-flowering shrub of Burma, having a red circular involucre; is a useful hardy plant.

LANTANA¹ **HYBRIDS**.—Are very brilliant and useful plants for the outer parts of the garden and on rocky places. The flowers, varying from pure white to dark crimson, are produced in great profusion and the florets often change colour with age. The pruning shears should be applied freely immediately after flowering to prevent seed from ripening, and all seedling plants should be destroyed, but a fine white variety produces no seed and may be planted with safety.

LIPPIA NODIFLORA—*Ratolya Bukan, Hiramana*.—A small creeping plant, abundant on moist, sandy, salt-impregnated soil; is used in Egypt as a lawn "grass," and might be put to similar use in other hot climates with advantage.

LIPPIA CITRIODORA²—*Lemon-scented Verbena*.—Thrives as a pot plant with protection from hot sunshine and regular watering.

PETREA VOLUBILIS.³—An elegant woody climber from tropical America, having stiff leaves with a harsh surface and abundant flowers having a dark blue corolla and pale blue persistent calyx. It thrives especially if planted out on the northern side of a house at 2,000 feet altitude; blooms during February to March, and is propagated by layers.

STACHYTARPHETA INDICA—*the Gervaoë*.—A blue-flowered plant from tropical America, having a long terminal stalk with the flowers to be seen near the

¹ *Lantana*, an old Italian name for the way-faring tree.

² *Citriodora*, lemon-scented.

³ *Petra*.—T. Cooke, in the *Bombay Flora*, points out that this name has been written *Petræa* in error, as it is named after Lord Petre. *Volubilis*, climbing.



LANTANA HYBRIDS

middle of the spike, the lower having fallen and the upper not yet developed. *S. MUTABILIS* has rosy flowers, but is otherwise similar. Both grow without cultivation at 2,000 feet altitude in a warm moist climate.

*TECTONA GRANDIS*¹—*Teak, Saag*—is mentioned here because the young trees are often raised from seed in gardens and planted on roadsides. The seed should be collected during the hot season, mixed with a quantity of dead leaves, buried in a pit with a covering of at least 6 inches of soil, and kept in a moist state. On being opened at the beginning of the following rainy season the seed should be sown at once, covered with 1 inch of leaf mould and watered if the weather be dry. Germination will take place within six weeks, and the seedlings should be transplanted to nursery lines as soon as the *first growth has become firm*.

VERBENA.—In districts having light rainfall the *Verbena* may be sown from June to January. The soil must have abundant decayed leaf mould and old cowdung, and should be frequently top-dressed with fresh compost as the plants spread. Cuttings or layers may be used to propagate choice sorts, but seed will give more vigorous plants.

VERBENA AUBLETI.—A pretty creeping annual with pinnate leaves and rosy flowers resembling the garden *Verbena*, but smaller. It may be sown at the end of the rainy season and will be in flower during January and February. It often springs up self-sown.

VERBENA VENOSA.—A dwarf spreading herbaceous plant; thrives in dry climates without special care.

VITEX NEGUNDO—*Nirguri, Nisinda, Nagoda*.—Is a useful and elegant fence plant for a district with heavy rainfall and 2,000 feet altitude.

¹ *Tectona*, probably from Teka, the Canarese name. *Grandis*, large.

LABIATEÆ, *The Mint Family*,

Are herbs or shrubs with aromatic or malodorous leaves; for example, *Tulsi* (*Ocimum sanctum*), Thyme, Mint, and the showy *Coleus*.

The hard-wooded species enjoy a deep sandy soil; the soft-wooded kinds require the same soil as is given for the *Coleus*. All the species enjoy an equable state of moisture in the soil and are easily propagated by cuttings or division, but a few, such as Thyme, yield seed freely, and propagation by seed is preferable.

AROMATIC LABIATES.—The following are all garden plants of easy culture, grown for the aromatic principle peculiar to each. A deep sandy soil kept moist is suitable. Propagation is easy by cuttings, or division, or seed, and slight shade during the hot weather is necessary.

BASIL—*Ocimum basilicum*—*Kam-kusturi*, *Vibudapattri*, *Nasbo*, *Srbja*, *Tirunitru-pachchai*.

“I pray your Highness, mark this curious herb,
Touch it but lightly, stroke it softly, Sir,
And it gives forth an odour sweet and rare,
But crush it harshly, and you'll make a scent
Most disagreeable.”—*Leland*.

BORAGE—Indian, *Coleus amboinicus*, (formerly *Coleus aromaticus*), *Pathar-chur*, *Pan-owa*.—Used in flavouring wine.

GURMAL—*Coleus barbatus*.—Used in pickling.

HOREHOUND—*Marrubium vulgare*.—Used against coughs and colds.

HYSSOP.—*Hyssopus officinalis*, *Badranjboya*.—This aromatic medicinal herb thrives in the light rainfall districts of Northern India when sown on a deep sandy soil. Propagated by seed and cuttings.

LAVANDULA STÆCHAS (French Lavender)—*Alphajan*, *Dhāru*.—Grows nicely in the Deccan when sown on a loose moist soil shaded during high sun.

LEMON-BALM—*Melissa officinalis*.—Grows nicely on a moist border with a northern exposure. Propagated by division and by seed.

MARJORAM—*Origanum marjorana*, *Murwa*.—Much used in cookery ; grows well on the shady side of a house from 1,500 feet altitude upward.

MINT—*Mentha sylvestris*, *Pudina*, *Vatalan*, *Chetnimarugu*.—Used in cookery.

PUDENA (Mint)—*Mentha arvensis*.

PATCHOULI—*Pagostemon*, *Heyneanus*, *Patch*.—Used for preserving cloth from insects.

PEPPERMINT—*Mentha piperita*.—Used as a stomachic, antispasmodic, and carminative.

ROSEMARY—*Rosmasinus officinalis*.—Used in hair washes.

SAGE—*Salvia officinalis*.—Used in cookery.

SAGE (Bengal)—*Meriandra bengalensis*, *Kafur-achajhar*, *Kafurkapat*.—Used for preventing insect attacks on cloth. Abyssinia.

SPEARMINT—*Mentha viridis*.

SAVORY (summer)—*Satureia hortensis* — Used in cookery.

SAVORY (winter)—*Satureia montana*.— Used in cookery.

THYME—*Thymus serpyllum*, *Ipar*.—Used in cookery. Thrives on the shady side of a house at 2,000 feet altitude upward.

TULSI—*Ocimum sanctum*, *Tulsi*, *Tulasi*.—Is sacred to Kristna and Vishnu. Unfortunately, its reputation has proved unfounded as repelling mosquitos. *O. gratissimum*, *Ram tulsi*, and *O. thyrsoiflorum*, the largest and prettiest of the genus, are widely cultivated.

LAVANDULA VERA—*the True Lavender*.—Grows well on the shady side of a building from 2,000 feet altitude, and is propagated by seed.

COLEUS¹ varieties are highly satisfactory from the brilliant colour they display when grown in a moist atmosphere with cloudy sky such as prevails at Khandala,



COLEUS HYBRIDS.

Western Ghats, from June till October, or is produced by shade *after* noon and regular watering. The most suitable soil is leaf mould prepared from garden sweepings and including much sandy earth, and propagation is easy from cuttings, but fine varieties are now procurable from seed.

¹ *Coleus*, from *koloos*, in reference to the filaments being joined and forming a tube round the style.

COLEUS BARBATUS—*Gurmāl, Main-mul*.—A small undershrub, having opposite, softly hairy, notched, ovate, obtuse leaves and spikes of bright purple two-lipped flowers. It is found on hills in wet districts and is cultivated for its fleshy roots used in pickling. It is grown from cuttings inserted during the rainy season in a bed of fine sandy soil, and, when rooted, planted out in lines 1 foot apart and 6 inches between the plants in the line, and regularly irrigated. The roots are sent to market during the cold season.

COLEUS THYRSOIDEA is a green-leaved species with bright blue flowers; its culture is the same as other forms.

DWARF COLEUS is highly valued as an edging, where it flowers freely, and is easily grown from seed or cuttings.

LEONURUS SIBIRICA.—An annual with opposite incised leaves and rosy flowers resembling those of *Coleus*. Thrives in Deccan if sown during the rainy season; is too common in some gardens.

SALVIA FARINACEA¹ (from Texas) has violet-blue flowers with a white tomentosa calyx, and is a pretty bedding plant at 2,000 to 5,000 feet altitude during September to May. Propagated by cuttings.

SALVIA INVOLUCRATA has the calyx, corolla, and tracts rosy, and blooms freely at the end of the rainy season. Propagated by cuttings.

SALVIA LANATA.—An herb from Himalaya, with large, long, woolly, white radical leaves. When a strong root is procured from its native district and planted in good soil in the plains the effect for a year or so is luxuriant development, but gradually the plant becomes exhausted.

¹*Salvia*, the old Latin name used by Pliny, from *salvo*, to heal, supposed medicinal qualities of some species. *Farinacea*, mealy.

NYCTAGINACEÆ,¹ *The Night Flowers.*

A group of herbs and shrubs, differing from those previously noted by only one of the floral envelopes being developed. It is the calyx, but in bright colour resembles the corolla.

ABRONIA UMBELLATA grows nicely at 3,000 feet altitude and upward if sown in September on a friable border with shade at noon.

The most important garden genus is—

BOUGAINVILLEA,² well-known climbers, depending on the coloured leaves appended to the flowers (*bracts*) for their beauty. A rich, thoroughly drained, loamy soil, heavily irrigated at considerable intervals, is all that is necessary to grow them. Pruning is not necessary, except to keep the plants within limits, and insects are not injurious. Propagated mostly by layers.

BOUGAINVILLEA SPECTABILIS³ is of rapid growth.

BOUGAINVILLEA GLABRA⁴ is of comparatively weakly growth, but strong enough for garden culture and without thorns.

BOUGAINVILLEA SPECTABILIS-SPECIOSA⁵ has brick-red bracts.

EUCHARIDIUM GRANDIFLORUM.—A variety of *E. concinnum*, a Californian annual with little purple flowers resembling *Clarkia*; thrives at 3,000 to 7,000 feet altitude if sown after the monsoon is nearly over.

PISONIA MORINDIFOLIA⁶—*Chinai-salit*.—A small tree with large, ovate, acuminate, entire, alternate leaves,

¹ *Nyctaginaceæ*, from the genus *nyctanthes* from *nox*, night, and *anthos*, a flower.

² *Bougainvillea*, after De Bougainville, a French navigator.

³ *Spectabilis*, remarkable. ⁴ *Glabra*, smooth. ⁵ *Speciosa*, beautiful.

⁶ *Pisonia*, in honour of William Piso, of Amsterdam, an eminent writer on Natural History. *Morindifolia*, having leaves like *morinda*.

which are remarkable for keeping green if in shade and becoming a pale yellow if fully exposed to the sun. In the loose open soil near to the foundation of a house this tree grows very freely. Propagated by cuttings.

MIRABILIS JALAPA¹ (*Marvel of Peru*)—*Gulabas*.—This splendid herb needs a rich freely watered soil, and is propagated from seed, which should be collected from bright-coloured flowers only, which have been grown beyond the influence of the pollen of common sorts. Imported seed generally gives flowers of varied colours with great profusion during August and October. The odour of the flowers of this plant is disagreeable to people not accustomed to it.

NEPENTHACEÆ,² *The Pitcher Plant Family.*

A small group of climbing undershrubs, native of the hottest and most humid regions of Southern Asia, and remarkable for a wonderful prolongation of the midrib in the form of a pitcher, which secretes water in which flies are drowned and decomposed. As Darwin puts it—a special arrangement for a supply of nitrogen.

The cultivation of *Nepenthes* is confined to districts where moisture and an equable temperature prevail. In the conservatories of the Calcutta Botanical Garden many specimens may be seen growing suspended from the roof in baskets of rich fibrous soil, which are watered twice daily during the growing season, and are propagated most easily by layering the upper parts. If bottom heat be available cuttings strike root freely.

¹ *Mirabilis*, wonderful. *Jalape*, jalap—it was believed to be the source of that drug.

² *Nepenthaceæ*, from the genus *nepenthes*, an old Greek name used by Homer. The word means grief-assuaging, and is used with reference to its supposed medicinal qualities.

POLYGONACEÆ,¹ *The Buckwheat Family.*

Includes *Kutu*, *Fagopyrum esculentum*, Rhubarb, and several riverside species of *Polygonum*.

ANTIGONUM LEPTOPUS.²—A charming climber, now popular in every garden, which thrives on deep, stony, rich soil, well drained and shaded from strong sunshine and watered freely during the monsoon dry weather. Seed planted in June will usually give some flowers the first season, but its full beauty is not developed till the second season, when there is a brilliant show of rosy flowers from August to November. When the leaves begin to fade, water should be withheld till May, when liberal manuring and water produce satisfactory results. The white variety may be selected from seed produced by white flowers and observed carefully when lately germinated, pale green at that time indicates white flowers in due course.

ANTIGONUM INSIGNE.—A variety with larger flowers.

COCCOLOBO GRANDIFOLIA.—A small tree of Central America, which thrives in slight shade and has a few very large, alternate, entire leaves without stalks, kidney-shaped. It is reared from seed, and thrives with shelter in a moist district.

COCCOLOBA UVIFERA.—Seaside Grape of West Indies.

MUCHLENBECKIA PLATYCLADA.—A shrub with bright green flattened branches, bearing small leaves of irregular form, which fall off very early. The flowers are small, red, and resemble those of the river-side plant *Parul*.

POLYGONUM AFFINE thrives from 1,000 feet altitude upward if sown during the monsoon on the margin of a tank with shade during high sun.

¹ *Polygonaceæ*, from the genus *polygonum*, from *poly*, many, and *gonu*, knee-joint, referring to the numerous joints of the stem.

² *Antigonum*, *anti*, against, and *gonum*, an angle.

POLYGONUM GLABRUM thrives with pot culture and regular watering, and is easily propagated by cuttings.

POLYGONATUM POLYSTACHUM (of the Himalaya) is suitable for clumps at an altitude above 5,000 feet, and bears abundant small white sweet-scented flowers; is propagated by division and cuttings of the lower part of the stem. It flowers during October.

RUMEX ACETOSA—*Sorrel, Chuka*.—An acid annual pot herb; easily reared from seed sown during June till January.

RUMEX SCUTATUS—*French Sorrel, Chuka*.—Grows nicely on the Himalaya from 2,000 feet upward, and is valued for flavouring culinary preparations. It may be sown in September.

RHEUM RHAPONTICUM, R. UNDULATUM, RHUBARB, and hybrids are much cultivated in Europe for the large leaf stalks which form a delicious sub-acid confection when boiled with sugar; grow fairly above 4,000 feet altitude with free irrigation and heavy manuring. Propagation is effected by dividing the root stock. The root of the former species yields part of the valuable drug Rhubarb.

By Truffant: Beet is found to do well with—

Nitrogen, - - - 8·30 per cent.

Potassium, - - - 11·30 „

Phosphoric acid, - - 14·10 „

RHUBARB—*Rivas, Persian*.—A large herbaceous plant, cultivated for its acid leaf stalks, grows satisfactorily only where the winter is cold enough to set vegetation to rest, as in Afghanistan, Persia, Himalaya and temperate climates. The leaf stalks have less fibre when grown where light is shut out and pots are inverted over the plants and fermenting material placed between to induce early and succulent growth. Abundant manure and water is necessary to ensure succulent growth. The dry root of some species is valued as a cathartic medicine with latterly astringent action.

PHYTOLACCEÆ,¹ *The Poke Weed Family.*

A small group of plants represented by the Virginian Poke Weed, *PHYTOLACCA DECANDRA*, an herb having alternate, oval, stalked leaves nearly 6 by 2½ inches, and numerous small white stalked flowers on extra-axillary branches. The flowers are succeeded by small dark purple berries filled with crimson juice which may be used as ink, and is believed to be valuable against chronic rheumatism and syphilitic pains. The leaves are acrid, but the young shoots boiled are eaten as asparagus in the United States. In kitchen gardens in the Deccan the plant thrives to perfection, and reproduces from seed.

*RIVINA*² *HUMILIS*, a very graceful herb, attaining 1½ feet in height and having alternate, slender stalked, oval, pointed, rather thick leaves and racemes of rosy flowers about ⅛ inch in width, succeeded by pretty red berries ⅛ inch in diameter, full of scarlet juice. It thrives with shade and moisture, and there are few more graceful objects in small pots in a conservatory for table decoration.

CHENOPODIACEÆ³ (including *AMARANTHACEÆ*), *The Goosefoot or Beet Family.*

A group of herbs, including *beet*, which yields a considerable part of the sugar supply of the world, and other esculents. As rapid development and increase of cellular tissue is desirable, a rich friable soil with abundant water while the crops are growing is specially desirable.

¹ *Phytolacceæ*, *phyton*, a plant, and *lac*, the colour lake, in reference to the colour of the berries.

² *Rivina*, in honour of A. Q. Rivinus, for some time Professor of Botany at Leipsic.

³ *Chenopodiaceæ*, from the genus *chenopodium*, from *chen*, a goose, and *pous*, a foot, in allusion to the shape of the leaves.



AMARANTUS GANGETICUS TRICOLOR.

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A manure recommended for this family has—Nitrate of soda, 2'20 lbs.; calcic superphosphate, 6'61 lbs; potassic chloride, 3'30 lbs.; calcic sulphate, 4'40 lbs.; ferric sulphate, 2'20 lbs—applied at the rate of 8 to 10 oz. per square yard, but those ingredients should be kept separated until used.

AMARANTUS OLERACEUS¹—*Sag, Mag, Pokla, Sada-Nuteeya, Lota-Kura*.—An excellent spinach, which by care in shading and watering during hot, or by sowing on raised beds of rich soil during wet weather, may be obtained throughout the year.

AMARANTUS CAUDATUS² —*Love Lies Bleeding*.—Is tall, with pendulous red flower spikes.

AMARANTUS GANGETICUS TRICOLOR.—Has leaves with several brilliant colours.

AMARANTUS POLYGAMUS—*Chumli sag*.—An excellent spinach.

AMARANTUS SALICIFOLIUS.—Has long narrow drooping leaves with brilliant colour.

SPINACEA OLERACEA — *Spinach, Paluck, Vusaley-Kiray, Pinnis, Palong*.— One of the wholesome pot herbs; may be grown in dry districts from June to January by providing a good rich soil thoroughly drained and watered freely.

GOMPHRENA GLOBOSA— *Amlana, Wadaku, the Globe Amaranth*.—Has globular flower heads in white, crimson, and yellow.

BOUSSINGALTIA BASSELLOIDES.—A climber attaining 10 feet in height and having perennial roots and annual stems bearing alternate, fleshy, entire, stalked, cordate leaves, and producing during June and July white sweet-scented flowers about $\frac{1}{16}$ inch in expansion, in racemes 6

¹ *Oleraceus*, used as an herb for food.

² *Caudatus*, like a tail, referring to the manner the inflorescence hangs.

to 8 inches in length. It thrives in districts with moderate rainfall in a rich loamy soil on a shaded trellis, and is propagated by small tubers that appear on the stem.

BETA¹ CICLA—*the Spinach Beet, Palung, Palak*—of which the leaves are used as Spinach; may be grown like red Beet, but may be transplanted freely.

BEET, BETA VULGARIS—*Chukander*.—Any soil that produces good crops of vegetables is fit for growing this crop if thoroughly tilled and manured with decayed town sweepings, poudrette, or dry fish. In the Deccan the seed can be sown with advantage at intervals of fifteen days from the beginning of April to the end of October. During hot weather a cool moist place must be selected for sowing seed, and the plants transplanted when about 4 inches high; but the best roots are obtained by sowing where the plant is wanted to finish its growth. Whether sown at once in the open ground or transplanted, the plants should be left twelve inches apart; this allows for the most forward to be gathered early, leaving space for the remainder.

In wet districts the rainy months should be avoided for sowing, but young plants may be obtained from dry districts and planted out as soon as the heavy rain is over. Beet seed degenerates in tropical climates, and should be imported, although seed be produced. If of good quality, transplanted—8 ounces will plant an acre; if dibbled where required to finish growth, 12 ounces will be necessary. The latter process gives roots free from branches, as is desirable for culinary purposes.

CELOSIA ARGENTEA²—*Kurdu, Sarwali, Debkoti, Swet Murga*.—Is highly ornamental and, while young, useful as Spinach. It grows freely on sandy soil during the rainy season.

¹ *Beta*, from *bett*, the Celtic for red, in allusion to the colour of the beet.

² *Celosia*, from *kelos*, burnt, in reference to the appearance of the flowers of some species. *Argentea*, silvery.

CELOSIA CRISTATA¹—*Murga, the Cockscomb*.—Is of easy culture on a sandy soil enriched with old cow-dung, and may be sown during the rainy season and transplanted carefully to prevent overcrowding; at each change the stem may be set lower in the soil if an extra dwarf plant be desirable.

IRECINE HERBSTII has opposite leaves two-lobed at the apex, of a dark maroon colour. It thrives in a cool moist climate. About 2,000 to 5,000 feet altitude, with protection from high sun, suits it. **I. AUREA RETICULATA** is a golden-veined variety.

ATRIPLEX HORTENSIS²—*Chandenbatwa, Orache*.—During the dry season this plant is easily raised for use as Spinach by sowing in rich irrigated soil.

BASELLA ALBA—*Poe-sag, Wahlea, Myal-ke-bajee*—and its red variety are climbers, requiring no special culture; the leaves are used as Spinach.

CHENOPODIUM ALBUM—Variety *viride*, *Chakwat, Dudi*, variety *rubrum*, *Chadenbatwa*.—Is widely cultivated and used as Spinach, being sown in dry districts from the middle of the rainy season onward, and in districts with heavy rainfall it is sown when the rain is nearly over, and the plants thinned out without transplanting. It may be grown on a soil having abundant salt, if otherwise rich.

ALTERNATHERA—*Telanthera ficoidea*³ (from Brazil).—An excellent edging, and much used in carpet bedding, its glowing crimson being greatly appreciated. The plant is propagated by cuttings, which may be set where the edging is required, during June to December where the rainfall is not excessive, and elsewhere when the rainy season is nearly over. A grub sometimes makes it

¹ *Cristata, crested*.

² *Atriplex*, from *a*, not, and *traphein*, to nourish. *Hortensis*, of gardens.

³ *Alternanthera*, in allusion to the anthers being alternately barren. *Telanthera ficoidea*, resembling a fig, in allusion to the leaves.

unsightly during June to July, and watering from a tank in which crushed green tobacco, tomato, or agave leaves have been soaked a few hours is recommended, but must be used with caution: if too strong it will kill the plant.

ÆRUA JAVANICA.

ÆRUA LANATA—*Chava*, *Chui-kallán*, *Kumri-pinda*, *Kepur-madhura*, *Kapur-phuti*, *Pindi-conda*, *Niliapulai*, *Sirrupulai*—is an elegant white tomentose herb, useful in flower bedding, and believed to have medicinal properties in *lithiasis*.

ÆRUA SANGUINOLENTA—*Lal siringhi*, *Bakta siringhi*.—A dwarf herb having opposite or alternate, oval, purple leaves and minute white flowers. This plant is a fine bedding subject, contrasted with *Pedilanthus tithymaloides variegata* and other pale foliage plants.

ARISTOLOCHIACEÆ,¹ *The Birth-Wort Family.*

This small family, as typified by the genus *Aristolochia*, is a group of herbs or shrubs, often climbing, with alternate, exstipulate, entire, or three- to five-lobed leaves and bisexual irregular flowers often resembling the head of a bird, with lurid colours. In several species the throat of the flower is furnished with numerous hairs pointing downwards and presenting no impediment to an insect going inwards, but on attempting to return the insect is met with a barrier of hair points, which impede egress until the pollen has been carried to the stigma. The fruit is a capsule resembling an inverted balloon. The species in general cultivation are:—

ARISTOLOCHIA FIMBRIATA—A pretty plant from Buenos-Ayres, with trailing branches about 1½ feet in length, bearing alternate, stalked kidney-shaped leaves, 1 to 2 inches in breadth, the upper surface deep green, having broad, pale lines on the veins, and in June solitary,

¹ *Aristolochiaceæ*, from the genus *aristolochia*, from *aristos*, best, and *lorcheia*, parturition.

axillary flowers of very curious form: the lower part of the tube being puffed out, and the expanded part on the inside dark brown, netted with bright yellow and surrounded by yellow hairs, $\frac{1}{3}$ inch in length, and having black tips; the hairs are turned inwards in the bud. The flowers are greenish-white on the outside, and measure 2 by 1 inches. The fruit is an oblong six-celled capsule, about $\frac{3}{4}$ by $\frac{1}{2}$ inch.

ARISTOLOCHIA ELEGANS is a beautiful free-flowering species of neat growth, from Brazil. It has cordate ovate leaves, smooth above and glaucescent beneath. The flowers have a slightly distended tube, which is suddenly bent upwards, the upper part dilated into a cordate cup-shaped limb of a rich dark purple, ornamented throughout with irregular branched markings of a creamy white and having a golden-yellow eye surrounded by velvety purple.

ARISTOLOCHIA RIDICULA.—A variety of the above.

ARISTOLOCHIA BRAZILIENSIS—*the Parrot Climber, Popat-wail*—grows rapidly in loose open soil, such as is found near the foundations of a house, flower freely in the cold season, and are propagated from seed cuttings or layers. The names *Popat-wail*, *Parrot-creeper*, and *Pitcher-plant*, are commonly misapplied to this genus.

ARISTOLOCHIA GIGAS—*the Pelican Flower*.—A Guatemalan climber, remarkable for the size of its malodorous blossom, large enough for a child's cap; the limb is purple inside and heart-shaped, with a long tail. This climber thrives grandly in the conservatory if planted in a rich soil kept open by numerous stones and watered sufficiently to keep the soil moist during the rainy season. During November to February it should be allowed to rest, and the dry vines may be cut away with advantage. It is most conveniently propagated by grafting to the roots of any free-growing species.

ARISTOLOCHIA GOLDIANA (from Old Calabar) has brownish mottled yellow flowers nearly a foot wide.

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EUPHORBIACEÆ,¹ *The Castor-oil Plant and Milk-bush Family,*

Are trees, shrubs, or herbs with minute unisexual flowers, but a few are showy, from the brilliant-coloured bracts surrounding the flowers and coloured leaves (*Acalypha*, *Croton*). A deep stony but rich soil is generally suitable, with abundant water during the growing season, and a distinct season of rest in December and January is necessary. Propagation by seeds and cuttings.

Several plants of this family have milky sap containing rubber: for example, *Ficus elastica*, a common window plant in the south of England.

ACALYPHA² WILKESIANA.—The varieties of this shrub have become common, but the full beauty of the plants is rarely developed. They are specially adapted for growth under a heavy rainfall; the large size and bright colour which the leaves develop at Khandala on the Western Ghats, where the rainfall is excessive, is seldom acquired elsewhere; but by giving a loose rich soil and abundant water the plants become very attractive even in a dry climate. **A. HISPIDA** is interesting from its very long pendulous spikes of minute crimson flowers, which appear in October.

ALEURITES³ TRILOBA—*Akroot*.—A tree with polymorphous leaves 4 to 12 inches in length on petioles 2 to

¹ *Euphorbiaceæ*, from the genus *euphorbia*, a name used by Dioscorides—“This word means, literally, plenty of food, and seems a strange name to apply to a genus of plants that are for the most part poisonous, unless, indeed, on the principle that a little of it goes a long way. The derivation, we are told, is from Euphorbus, physician to Juba, King of Mauritania, who is said to have brought the plant into use.”—ALCOCK.

² *Acalypha*, the Greek name for the nettle: *a*, privative; *kalos*, beauty; *aphe*, touch.—“Plants without beauty and with stinging properties.”—Graham’s *Catalogue of Bombay Plants*. Evidently the name was not compounded in view of the favourite varieties of this day.

³ *Aleurites*, from *aleiar*, wheat flour, in allusion to the young shoots being covered with mealy powder.

2½ inches in length and having two glands at the top. The small white flowers are succeeded by sub-globuse, fleshy, smooth, olive-coloured fruit containing one or two large hard seeds, rich in oil and with a furrowed covering resembling a walnut. This tree is useful for avenues and public places south of 15° N. lat., where it thrives with little care.

CODIÆUM VARIEGATUM¹—*Croton of Gardens*.—Select varieties of *Croton* maintain their position in gardens, and are well worthy of attention. The select sorts of former years are still forward, although they appear under different names and are called new varieties. The soil necessary is one part good reddish friable loam, one part stable sweepings that have been thoroughly decomposed in a *moist* pit, one part old lime and broken bricks or potsherds. Generally, pots are advisable, but if the plants can be planted out in the above compost with perfect drainage and thin shade, the result is better. Protection from strong wind and direct sunshine is necessary for the large-leaved varieties, but fine plants of the small-leaved sorts may be seen planted out fully exposed to the sun. For surface dressing established plants dried fish are an excellent manure.

Thrip is the chief insect enemy of the *Croton*, and requires kerosene emulsion applied in spray or with a sponge at short intervals during the dry months.

Propagation, as a rule, is very easily effected. Many varieties may be rooted simply by placing the cuttings in water, which should be kept fresh by frequent renewal, but a few of the slow-growing varieties are difficult to root without all the arrangements detailed at page 22. Cuttings of slow-rooting varieties may be grafted to cuttings of quick-rooting sorts with little trouble, and the result is more vigorous growth than otherwise.

¹ *Codiaeum*, from *codebo*, the Malayan name of one of the species. *Variegatum*, with various colours.

CROTON ELUTARIA.—The sweet wood of Bahamas yields the Cascarilla Bath of commerce; it is a shrub bearing peltate fringe of orbicular scales beneath the entire leaves. It is difficult of propagation, but may be raised from fresh seeds sown where the plant is wanted in moist parts with 2,000 feet altitude.

CROTON TIGLIUM—*Croton Oil Tree*.—A shrub bearing alternate, entire leaves having star-shaped hairs at intervals.

CROTON NIVENS, from Bahamas, has alternate leaves bearing very numerous stellate hairs.

EUPHORBIA PULCHERRIMA—*Flor de pasque*.—A rapid-growing shrub with small flowers surrounded by large scarlet leaves, *bracts* magnificent during the cold season. Soil:—Two parts good garden soil, one part broken pots or bricks, one part old manure. Thorough drainage is necessary, and free watering while growing fast. A white and a double scarlet variety are in cultivation. To make a very dwarf *Poinsettia*, at the beginning of September cut a deep notch about 6 inches from the end of a branch; when the milky sap has dried up tie some leaf mould in moss round the wound, roots will soon appear, then the little plant may be cut off, potted, and placed in a frame a few days.

EUPHORBIA HETEROPHYLLA, a miniature annual *Poinsettia*, which grows freely from seed.

EUPHORBIA JACUINIFLORA—*Dalechampia xylophylla*.

EUPHORBIA SPLENDENS.—A thorny shrub, producing bright red flowers during January to March. The same treatment as *Euphorbia pulcherrimi* is suitable.

EXCÆCARIA BICOLOR.¹—A shrub having ovate, lanceolate leaves, olive-green on the upper and crimson on the

¹ *Excæcaria*, from *excæcare*, to blind, in allusion to the acrid juice of the plant. *Bicolor*, of two colours, referring to the leaves.

lower side, and bearing minute flowers during the cold season. The treatment detailed under *Crotons* suits it.

FLEUGGIA LEUCOPYRUS—*Pandarfali*.—Is an elegant shrub of the Deccan. It produces long slender branches from near the root, which have small leaves, and bear small yellowish flowers with a faint disagreeable odour, and the sexes on separate plants. The female is loaded during the rainy season with small pure white berries, and the weight of fruit bending the branches gracefully is very attractive. The plant thrives on a raised bank of stones and rich soil without special watering, and is propagated by seed.

HEVEA BRAZILIENSIS—*Para-rubber*.—A small tree with alternate three-foliolate long-petioled leaves, and panicle flowers with a five-toothed calyx, no corolla, and five stamens with filaments forming a central column. It is found to grow fairly in moist districts of Ceylon, and the seeds need to be planted as soon as ripe.

HURA CREPITANS.—A tall tree with alternate heart-shaped smooth leaves, having two glands at the base of the blade, and the bark closely beset with sharp thorns. The fruit is a woody depressed sphere consisting of numerous carpels which separate from each other when ripe, and with a noise like a pistol-shot. This tree thrives at Khandala, where the rainfall is excessive; it also grows freely at Poona, and is propagated by seed.

JATROPHA¹ **GLANDULIFERA**—*Undirbibi*.—An extremely local plant growing at Pandharpur, which has a legend to account for its presence there. It is said that a cultivator ploughing his field was asked by many passengers what he was going to sow, and to one he irritably gave a very rude answer; this one was an incarnation of Vishnu, who cursed the field, saying it would produce this plant. The legend is probably very

¹*Jatropha*, from *iatron*, a remedy, and *phago*, to eat—some of the species possess medicinal properties and are nutritious food.



JATROPHA GLANDULIFERA.

old, and its earliest date would be very interesting as showing the persistent occurrence of a local plant. *Undirbibi* has small, pale, greenish-yellow flowers. An illustration of it is given because *Jatropha gossipifolia*, a very glandular common naturalised shrub with red flowers, from Brazil, has been mistaken for *Undirbibi*.

*JATROPHA MULTIFIDA*¹—*the Coral Plant*.—While young and thriving, a very handsome plant, with alternate digitate leaves and terminal corymbs of bright red flowers.

JATROPHA HASTATA.—A pretty shrub bearing fiddle-shaped leaves and bright crimson flowers in terminal corymbs.

JATROPHA CURCAS and *J. GOSSIPIFOLIA*² are very free-growing shrubs, suitable for rapidly hiding some unsightly objects. Propagated from seed.

*JATROPHA PODAGRICA*³ is a small shrub with a remarkable gouty stem, large peltate leaves, and small bright red flowers. It is often grown in conservatories, but thrives well on a bank of rich soil fully exposed to the sun and frequently watered.

*MANIHOT UTILISSIMA*⁴—*the Tapioca or Cassada Plant, Cassada*—is a soft-wooded milky shrub having alternate palmate leaves of three to seven oblong, lanceolate, entire segments, small yellowish flowers, and thick cylindrical roots containing much starch. Two plants occupying 4 square yards of soil produced 45 lbs. weight of roots giving about 7 per cent. of starch, after growth during one year in a rich, irrigated loamy soil at Poona. In January, cuttings 18 inches in length may be planted 6 feet apart among a crop that is to be removed early, and, being hoed frequently and irrigated if dry, the roots

¹ *Multifida*, much divided.

² *Gossipifolia*, having leaves like the cotton plant.

³ *Podagrica*, gouty, referring to its swollen stems.

⁴ *Manihot*, the Brazilian name of the genus. *Utilissima*, most useful.

will be ready for crushing by wooden rollers to obtain the starch in the following January. When the pulped root is mixed with water the starch falls to the bottom, and having been thoroughly washed, is thrown in drops from a sieve on to a hot plate—the result is Tapioca. Iron vessels should not be used, as the iron discolours the starch.

MANIHOT GLAZIOVII—*the Ceara Rubber* (of Brazil).—Bears flowers and seed abundantly with ordinary garden treatment. It has a straight, smooth stem and alternate three-lobed leaves. The oldest trees known yet have not yielded any rubber, probably from the dry climate. In a moist climate they are worthy of trial, and may be set out 10 feet apart.

PEDILANTHUS TITHYMALOIDES¹—*Valaytee-sheer*.—This dwarf succulent undershrub forms a convenient edging adapted for shady place in a deep open soil. It is propagated by inserting cuttings where it is to remain. A variegated form found at Gunesh Khind in 1870 is a very showy bedding plant for sandy soil.

PHILLANTHUS NIVOSUS.—A very neat shrub of tree-branching habit, having oval alternate leaves about 1½ by 1 inch, and frequently mottled white. It is a very desirable pot plant, thriving well under slight shade, and propagated by cuttings of the greener portions.

PUTRANJIVA ROXBURGHII²—*Putra-jan, Putra-jiva, Jewan-putr*.—A moderate-sized evergreen tree. It is of slow growth, thrives in a deep alluvial soil without irrigation, and is propagated by seed. The young trees grow rapidly with shade and moisture, and are difficult to transplant.

¹ *Pedilanthus*, the slipper flower, in allusion to the shape of the flower. *Tithymaloides*, resembling the genus *tithymalus*.

² *Putranjiva*, *putra*, a son, and *jiva*, life. The nuts are strung round the necks of children to preserve them in health. *Roxburghii*, in honour of W. Roxburgh, M.D., a famous botanist, who worked in India.

PHYLLANTHUS DISTICHUS—*Harparowra*, *Russa-usereki*, *Loda*, *Nori*.—A small tree having simple leaves 1 to 3 inches long, on deciduous branchlets which simulate pinnate leaves, but may be determined as branches by the presence of flowers in the axils of the leaves. The fruit comes in clusters from the old wood, and is used in pickles and cooking for its acid.

RICIMUS COMMUNIS—*the Castor Oil Plant*, *Yerendi*.—The coloured varieties are effective in large gardens and public parks, and may be raised on a heap of a mixture of sweepings, stones, and soil, earthenware water pots (*gurhas*) being sunk at intervals to retain water, and a few seeds inserted at 2-foot intervals, to be thinned as growth extends. The outer plants may have the points pinched out to induce branching.

SYNADENIUM GRANTII.—A *Euphorbia*-like plant with smooth terete stem and fleshy leaves. It grows slowly in dry districts with border treatment.

PIPERACEÆ,¹ *The Pepper Family*.

A small group of plants characteristic of the most humid districts of India, and including the Pepper and Betel leaf vines.

PIPER BETEL²—*Tumboolee*, *Pan-kee-jhar*.—The *pan* vine is a native of the most humid forests of our southern districts, but it is found that a higher price is obtained for leaves grown in dry districts with a close imitation of the conditions it thrives under naturally than is procured for leaves grown in the natural habitat of the plant.

For *pan* cultivation a soil of the highest natural fertility is necessary, with efficient drainage, and sweet water for irrigation. Well irrigation is generally used because the level of the *pan* garden rises year by year as

¹ *Piperaceæ*, from the genus *Piper*, the old Latin name of pepper.

² *Betel*, one of the vernacular names of the plant.

the cultivation goes on, and it is not often that canal irrigation can be adapted to such a condition and at the same time be free from soakage from the canal. The proximity of a well of moderate depth ensures the downward sinking of superfluous water as well as a means of irrigation.

In laying out a *pan* garden, operations are commenced at the end of the rainy season by digging or ploughing 18 inches deep, meanwhile affording a medium dressing of decayed sweepings and laying out at a distance of 18 feet apart alternating drains and irrigation channels, so that each channel waters a breadth of 36 feet, and this space is bounded by an open drain, which prevents water from stagnating.

The irrigation channels should be straight, and in laying down their course the fact that the surface must be raised 6 inches yearly should be borne in mind. A close fence should enclose the whole of the garden, because hot winds as well as trespassers must be excluded. For a fence, the plant that is easily procurable locally, and at the same time efficient, should be selected; a line of *Sheweri* (*Sesbania aegyptica*) or of *Vera ouse* (*Saccharum procerum*) protected on the outside by a line of *Sher* (*Euphorbia tiricula*) may be employed. In northern districts, where the making of "chicks" from the stems of a tall grass is an established industry, it will be cheaper to use those "chicks" rather than grow trees to serve the same purpose, while trees are generally used where the "chicks" are costly. Of suitable trees, *Pangara* (*Erythrina indica*) is the best. Seeds may be planted 6 inches apart, to be thinned out to 18 inches apart as they grow up; and as it does not grow rapidly at first, a few plants of *Sheweri* (*Sesbania aegyptica*) should be sown with the former, the *Sheweri* to be removed as soon as it is not required.

If the fence is not close when the *pan* vines are planted, matting must be arranged to make up the deficiency. The planting of the fence and the supports should be made as soon as the rainy season has set in. For sup-

ports two distinct systems are available: one, dry sticks to be covered by "chicks"; the other, living trees which keep out excessive light by their own foliage. A tree of *Augusta* (*Sesbania grandiflora*) or of *Neem* (*Melia azadirach*), at intervals of 10 or 12 feet, is desirable to strengthen the line. The lines of trees should be 4 feet apart, except at the drains and water channels, where the width may be 6 feet—thus from the centre of one drain to another the distances of the lines of supporting trees will be, in feet, 3, 4, 4, 4, 6, 4, 4, 4, 3=36. The cuttings may be planted about the beginning of January; it is not of importance what part of the stem is taken. A suitable length of cutting is 9 inches, which should be inserted about 8 inches in the soil, four cuttings being planted at the bottom of trees about 18 inches apart in the line. In Mysore, two cuttings 3 feet in length are doubled and nearly buried in the soil, the four ends being left protruding, give rise to vines. Water will be required daily for ten days or so; afterwards, as the roots appear, one watering in two days will be sufficient, and when growth is fully established, water, once in three or four days, will be sufficient. Rain in slight showers is not considered in this cultivation, because so much is detained by the foliage, and evaporates without reaching the roots. Some cultivators consider rain injurious, and actually irrigate freely after rain with a view to washing it out. This, undoubtedly, is a part of the superstition that surrounds the cultivator from cradle to cremation; the fact that his leaves do not keep well after a fall of rain is not likely to be remedied by pouring more water on the soil.

When the cuttings begin to grow, if the supporting trees are strong enough, the vines may be led on to the trees directly, but it is safer to insert a stick to serve as a support for a few months until the trees gain strength. After-culture consists of perfect weeding, regular tying up of the leading shoots, and carefully regulating the degree of light by judicious pruning of the supporting trees. During the second hot season, the vines having grown beyond reach and bare at the bottom, the whole

are loosened from the supports, wound in a circle, and all except the points buried at the base and covered with manure and fresh soil brought from the outside. The dressing of manure and fresh earth is repeated at the end of the rainy season. If the work has been very carefully attended to, a few leaves may be fit to gather near the end of the second year, but more frequently the gathering must be deferred till the third year, and if carefully managed the garden will "bear" for ten or twelve years, by that time the supply of good earth in the neighbourhood will be exhausted, and it may be more profitable to devote the garden to other crops.

Pan leaves measurement:—

400 leaves,	-	-	-	-	1 kavli.
44 kavli,	-	-	-	-	1 kurtan.
4 kurtan,	-	-	-	-	1 ojhe.

PEPPER VINE and BETEL NUT—*Piper Nigrum*, *Miri*,
Kala Miri.

PEPPER VINE.—The pepper plant greatly resembles the *pan* vine, and thrives under the conditions detailed for that plant, but the peppery bean being less perishable and better adapted for transport than *pan* leaves, the cultivation of pepper is confined to the hot and moist districts that are the natural habitat of both plants. Well-established areca-nut plantations are generally used for growing pepper, therefore the cultivation of both of those plants may be noted together. The ground for *Areca catechu*, *supari* plantation, must be naturally a rich loamy soil, if practicable with water obtainable about 3 feet beneath the surface, and the means of good drainage, because, although abundant water is necessary, stagnant water is decidedly detrimental. The laying out of the ground for irrigation and drainage is exactly such as is detailed for the *pan* vine; in short, alternating irrigation channels and drains at a distance apart of 18 feet.

A strong fence having been planted, *bananas* or other trees intended for nurses are set out in lines 10 feet apart,

and *supari* trees, three years from the seed, should be planted 10 feet apart in lines alternating with the nurses. The nurse trees must be kept in subjection, shelter and slight shade is wanted, not overcrowding. Manure must be given at regular intervals, at first half a head load to each tree twice a year, and irrigated twice a month in dry weather. By the tenth year the trees should 10 feet in height and shading the ground, then the *bananas* and other nurse trees should be removed, and during August cuttings of pepper vines may be planted at the base of each tree, and the runners trained up the stem; side shoots may be stopped and the plantation kept clean, regularly watered three times a month in dry weather, and manured twice a year. In the fourth year fruit is produced, and the pepper vines bear four or five years, then are pulled down and re-planted. *Areca catechu* is called in different districts *Supari*, *Mari phopholi*, *Goo-vaka*, *Gooa*, *Poko chelloo*, and in commerce *Betel-nut*. It is propagated from seed ripened on the tree, planted in sandy soil, and kept moist and shaded.

PIPER PORPHYROPHYLLUM is found to grow fairly in a moist conservatory in the southern districts with ordinary treatment.

PIPER CHABA—*long pepper*—has many prominent lenticles and leaves which appear alternate from the want of development of the opposite one, the leaves being entire, equal at the base, where it carries a pointed growth like a bud.

PEPEROMIA SANDERSII.¹—A dwarf plant having thick, heart-shaped stalked leaves about 4 by 3 inches, rising from the ground, and having the stalk inserted within the margin (peltate) and alternating bands of dark green and white curving from the insertion of the stalk to the margin. Propagation is easily effected by cuttings of leaves with their stalks inserted in sandy soil and kept moist. Brazil.

¹ *Peperomia*, from *peperi*, pepper, and *omoios*, similar.

PEPEROMIA MARMORATE¹ resembles the above, but has the white bands interrupted by dark green. Brazil.

MYRISTICACEÆ, *The Nutmeg Family.*

A small group of fragrant trees, growing in hot, moist climates, and producing the Nutmeg and Mace tree.

MYRISTICA FRAGRANS—*Jaiphal*.—The principal source of those valuable spices are the Molucca islands, where, in a hot and humid climate and deep alluvial soil, the trees thrive especially, but cultivation has been successful in moist districts of Ceylon at low altitudes similar to the position selected for Cocoa. The trees are raised from fresh seeds which have not been treated with lime, as market supplies are prepared. They begin to bear about ten years of age, and continue many years, improving in fecundity as growth extends; the average produce is stated at 3 lbs. of Nutmegs and 1 lb. of Mace to each tree. Several species of the genus *Myristica* grow in Southern India and produce oblong seeds larger than, and with little of the special fragrance of, the true Nutmeg, but are excellent ornamental trees in hot, moist districts.

LAURINEÆ, *The Laurel Family.*

A few species of this family occur in great numbers on the Western Ghats, including trees with entire leathery leaves, often with pungent odours, and having inconspicuous yellow or greenish flowers with anthers opening by two or four small valves which open downward. The most important is—

CINNAMONUM ZEYLANICUM—*Dalchini, Kooroondoo, gatri, tikhi taj, canella, the Cinnamon Tree*.—This handsome tree thrives in gardens from Bombay southwards in moist districts, but the bark is not valued as Cinnamon.

¹ *Marmorate*, like marble.

It is in deep, very sandy soil, free from stagnant water, and in a hot damp atmosphere that good Cinnamon bark is produced ; and, by cutting back the branches, long rods having bark of equal thickness are produced.

The soil of some of the fine gardens on the sea-board of Ceylon contains about 97 per cent. of sand. The tree is propagated from seed, and lives to a great age.

LAURUS CAMPHORA (of Southern China and Japan).—The Camphor tree has alternate exstipulate entire leaves, having three prominent ribs; and is cultivated largely for its camphor, which is extracted by distillation. It requires a moist climate, and, for the production of camphor, abundant sunshine and a sandy soil. Trees take several years to yield, and get little cultivation beyond seed sowing where trees are wanted.

LAURUS NOBILIS—the *Bay Laurel*—thrives at 2,000 to 7,000 feet altitude in slight shade on a regularly watered soil ; its leaves are valued for flavouring.

LITSEA PERSELLA—the *Engkalla* (from Sarawak).—A fruit tree 40 to 60 feet high. The globular fruit is produced in a green calyx 4 to 5 inches across. The fruit is 1½ inches diameter, smooth, red, pulp fleshy green, flavour delicious while raw or in curry.

THE AVOCADA PEAR—*Persea gratissima*.—Esteemed as a vegetable in Tropical America and West Indies. Thrives in moist southern districts, but is not considered equal to a Mango, which would grow under the same conditions.

THYMELÆCEÆ, *The Daphne Family.*

A group of trees or shrubs abundant on mountain ranges in the Tropics, and having a tough fibrous bark, from which paper of unusual strength is manufactured in Nepal. The calyx only is developed in this family, and is usually coloured.

DAPHNE MEZERUM, with fragrant flowers, which appear before the leaves, and DAPHNE CNEORUM, which has a trailing habit and rosy fragrant flowers, grow nicely at 5,000 to 7,000 feet altitude.

LASIOSIPHON ERIOCEPHALUS—*Raméta*.—Grows freely at 4,000 feet altitude, and bears abundant small yellow flowers in dense heads.

PHALERIA LAURIFOLIA is a shrub with opposite bright green leathery leaves, and white flowers with a long tubular receptacle, arranged in umbellate spikes at the ends of branches. On the hills it thrives with open treatment, but near sea-level requires shade and abundant water.

PROTEACEÆ.¹

This is a group of trees and shrubs common in South Africa and Australia, and represented in our gardens by

GREVILLEA ROBUSTA,² a handsome tree, in fifteen years attaining 30 feet in height, and having alternate exstipulate twice pinnate leaves, and, when mature, orange-coloured flowers in abundant racemes. The tree is particularly graceful while young, plants six months from the seed being 2 or 3 feet in height, and if grown in pots specially useful for house decoration. A deep open soil, with frequent watering and 2,000 to 5,000 feet altitude, suit it. Raised from seed.

LEUCADENDRON ARGENTEUM—*Witteboom* (or *Silver Tree of South Africa*)—would surely thrive at Poona, or any dry climate from 2,000 to 5,000 feet altitude, on the northern side of a building, and is desirable for its silvery foliage.

¹ *Proteaceæ*, from the genus *Protea*, from *Proteus*, the versatile sea-god; in allusion to the diversity of the species.

² *Grevillea*, in honour of C. F. Greville, a patron of botany. *Robusta*, robust.

MACADAMIA TERNIFOLIA—*the Queensland Nut*.—A small tree having linear, serrate leaves in whorls of three and producing an edible nut, in size and taste like the hazel nut, and about $\frac{3}{4}$ inch diameter. The tree grows nicely with ordinary garden treatment at 2,000 feet altitude, and endures very heavy rainfall on the Western Ghats without injury, and has given fruit at Gurndy, Madras, under shade. It would be a valuable tree at 4,000 to 6,000 feet altitude.

ELÆAGNACEÆ,¹ *The Oleaster Family.*

A group of shrubs having brown or silvery peltate scales on the leaves, which have an elegant effect in dinner table decoration. Those shrubs abound at 4,000 to 5,000 feet altitude, and some of the family have tubercles on the roots for the assimilation of nitrogen, as it occurs in the Pea family.

ELÆAGNUS LATIFOLIA—*Ambgal, Nurgi*.—Is given to climbing if in shade; has alternate oblong leaves 4 to 5 inches in length with silvery scales, elegant under lamp-light, small pale yellow flowers, and edible elliptical fruit 1 inch in length. It may be raised from seed or layers, and does not require special care at 2,000 to 5,000 feet altitude.

ELÆAGNUS CONFERTUS VARIEGATA is a shrub with Holly-like leaves, with yellow blotches and star-shaped scales on the lower face. It grows nicely in gardens with slight shade, the greater the altitude up to 5,000 feet the more the plant appears suited. It is easily increased by layers.

THE UPAS TREE—*Antiaris toxicaria, Ritigaha* (Ceylon).—This interesting tree grows to great size in the Concan in moist sheltered situations, and is worthy of

¹ *Elæagnaceæ*, from the genus *elæagnus*, from *elaia*, the olive, and *agnos*, the chaste tree, in allusion, perhaps, to the combined resemblance to those trees.

note from the tales that are told of its properties of destroying life of many sorts; those tales are greatly exaggerated, but that they have a substratum of truth is not to be denied. The Nettle and its effects are very familiar, and that other plants have offensive properties is well known; any one who has cut down *Euphorbia tirucalli* is not likely to forget its effects, and although the writer has been familiar with the Upas tree during many years, this need not be taken as denying the existence of an effluvium which causes cutaneous eruption. The tree thrives also in a dry climate with the usual watering, and is propagated by seed or layering.

URTICACEÆ,¹ *The Mulberry and Fig Family.*

We have familiar examples of this family in the Banyan, *Ficus bengalensis*, Wud, the cultivated Fig, *Ficus carica*, Anjeer, and the Mulberry, *Morus alba*, Toot. The flowers are inconspicuous, and in the cultivated and wild Figs are found enclosed in a hollow flower stalk (the Fig).

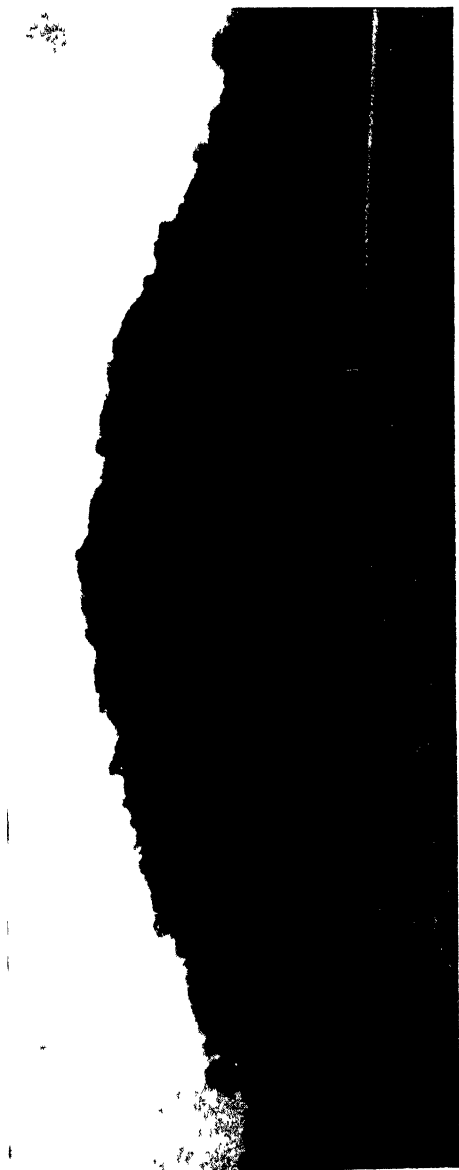
ARTOCARPUS² CANNONI.—A shrub 6 feet in height and having alternate, stipulate, stalked leaves, glossy, and of a rich bronzy crimson tinted with purple, and varying in form from heart-shaped to deeply three-lobed. In a rich loamy soil, occasionally watered, it thrives in the Deccan with full exposure to the sun. It is difficult to propagate. Cuttings made from side shoots taken off at a joint during October and planted in pure sand with a bell glass and kept in a propagating frame root sparingly.

ARTOCARPUS INCISA—the Bread-fruit Tree—is ornamental in districts having a humid atmosphere and equable temperature; at Poona it is grown on the river bank, sheltered from hot winds. It requires a rich loamy

¹ *Urticaceæ*, from the genus *urtica*, from *uro*, to burn, in reference to the burning properties of the acrid sharp-pointed hairs.

² *Artocarpus*, *artos*, bread, and *carpos*, fruit.

BANYAN IN CALCUTTA BOTANIC GARDENS.



soil, and is propagated by suckers from approved trees. Seedlings are found to vary greatly, many not being worth growing as fruit trees.

ARTOCARPUS INTEGRIFOLIA¹—*Jack Fruit, Phunnus, Kanthal*—enjoys a red loamy soil, rich in vegetable matter, with heavy rainfall or irrigation, and is raised from seeds. The fruit is produced from the stem and larger branches, and often from a part of the stem that is covered with earth. On the Western Ghats, to germinate, the seed is wrapped in grass and placed on the roof of a house until the shoot has extended 6 inches; the tender plant is then gently twisted round a stick and planted deep enough to cover the twist, this induces underground fruit.

CONCEPHALUS² **SAUVEOLENS**.—A shrub with large, alternate, stipulate, ovate, entire leaves and minute whitish, sweet-scented flowers in small heads produced during the cold season. If planted in a rich soil with shelter and frequent watering this plant grows rapidly, producing long trailing branches. Propagated by cuttings.

FICUS MYORENSE has a general aspect similar to the *Wud* or Banyan tree, but differs in the leaves and young shoots, being clothed in woolly hairs of a coppery tint. It is used as a road-side tree in very moist districts, and is reared from large cuttings.

FICUS PARCELLI has variegated leaves, and thrives in a deep loamy soil with abundant stones and occasionally irrigated during dry weather and shaded from strong sunshine. Sea level at 30° from the equator, and proportionate altitude where the mean temperature is higher, suits it. In South Africa it is specially ornamental, and it is easily propagated by layers or by cuttings under glass.

¹ *Integrifolia*, entire-leaved.

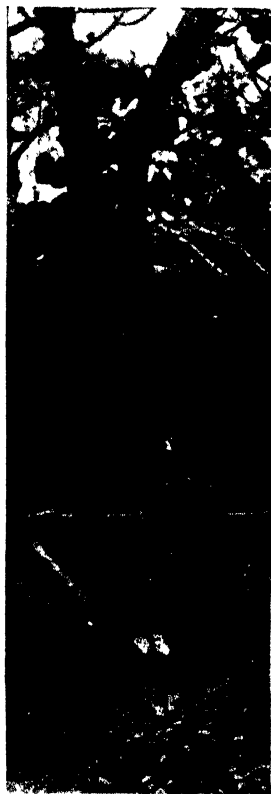
² *Conocephalus*, *konos*, a cone, and *kephalos*, a head, the head of flowers are cone-shaped in some of the species.

FICUS RELIGIOSA—*Pepul*, *Bo*.—The seed of the *Pepul* may be sown as detailed for the *Wud*. It often germinates in pots containing other plants. Cuttings do not root freely, but large trees may be transplanted with little trouble during the cold season although the greater part of the roots have been cut off. When large *Pepul* trees have been transplanted, a forest of young plants spring up from the roots left in the ground.

FICUS ROXBURGHII.¹—A spreading tree, having alternate, cordate, slightly acuminate, entire leaves on young plants attaining 15 by 10 inches. It thrives with ordinary border treatment in a very moist climate and is propagated by cuttings.

FICUS STIPULATA—*Bui-dumur*.—Like Ivy in other climes, this Fig covers walls at Calcutta, clinging by rootlets. It has small alternate short-stalked, ovate, entire, harsh leaves and stipules in opposite pairs. It may be propagated by cuttings from branches near the base.

FICUS VOLUBILE.—A small tree, having elliptic, acuminate, oblique leaves with ten veins alternating on each side of the midrib and between the veins groups of small white spots. The orange-red fruit is in pairs, abundant, $\frac{1}{4}$ inch diameter with $\frac{1}{2}$ inch stalk.

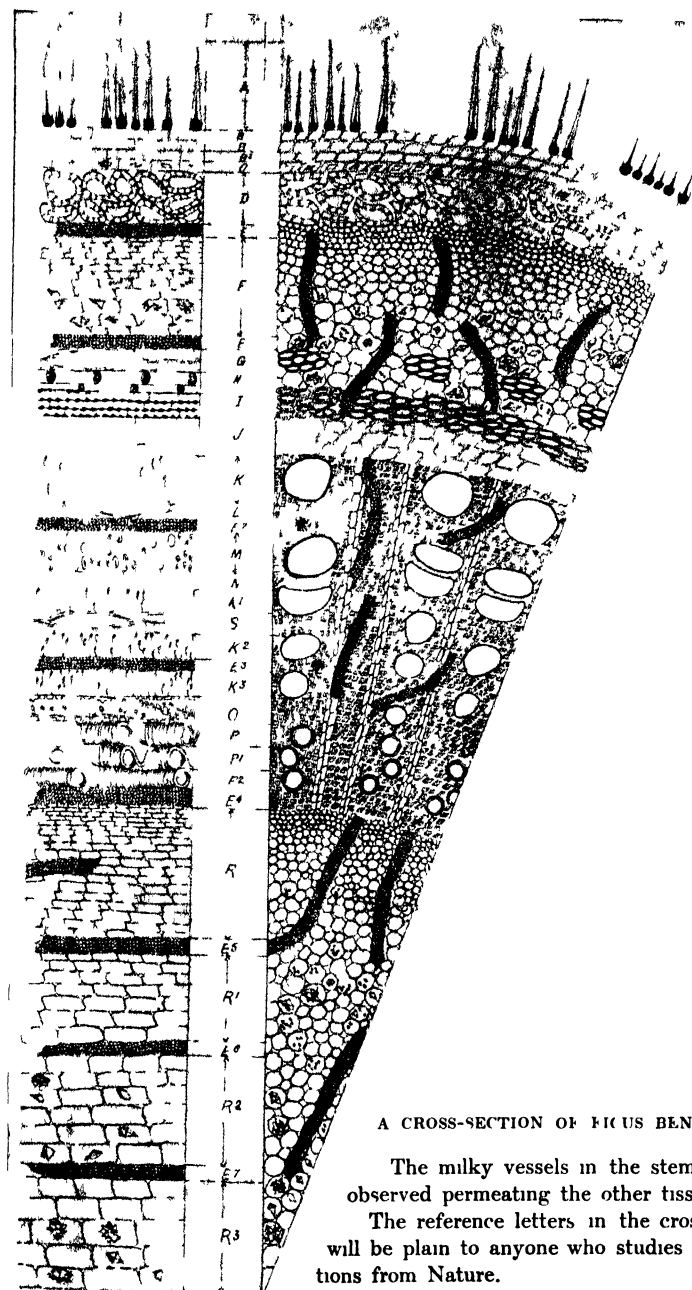


FICUS HISPIDA.
(Reputed a good guide in water finding.)

¹ *Roxburghi*, in honour of W. Roxburgh, M.D., author of the *Flora Indica*.

FICUS BENGALENSIS.—*Wud.*—It is sometimes necessary to raise this tree from seed in gardens, and as the necessary treatment differs from that given to other seeds, it may be noted here. If the seed is sown in ordinary soil it rarely germinates, but if sown in a pot on a mixture of equal parts crushed bricks and leaf mould and the pot kept in a moist place the seed germinates freely. The seedlings grow rapidly, and make more upright trees than cuttings make. This is one of the finest road-side shade trees, speedily realising Tennyson's "Broad ambrosial aisles," by covering the road completely.

THE FIG.—*Ficus carica*, *Anjeer*, *Dumar*, *Ténatti*.—The Fig needs a rich loamy soil with abundant lime and thorough *drainage*. Plants are easily raised from cuttings of one year old wood planted in a shady place in February and transplanted to their permanent quarters at the beginning of the rainy season. The distance apart varies from 10 to 12 feet. At first one vigorous shoot should be encouraged to grow straight up, and when it has formed 18 inches of well-ripened wood, it may be cut back to that height and encouraged to send up three or four branches. When these have made 1 foot of ripened wood they may be shortened and encouraged to branch again; all weakly shoots must be cut out completely, and any disposition to overcrowd prevented. The shoots resulting from the last pruning may be encouraged to grow up and ripen fruit; when grown about 8 feet and the fruit ripened, it is advisable to cut back nearly to the base. By this system of forming the tree at first no fruit is obtained the first year, but from the second heavier crops than are otherwise obtainable may be gathered afterwards, and in the meanwhile the ground should be occupied with crops. Water should be given freely when the soil is dry up to about the end of January, earlier or later according to the condition of the fruit. If watering is too long continued, or more than is necessary is given, the fruit becomes insipid. When the fruit is full grown it is necessary to protect each one separately until it is



A CROSS-SECTION OF *FICUS BENGALENSIS*.

The milky vessels in the stem may be observed permeating the other tissues

The reference letters in the cross-section will be plain to anyone who studies such sections from Nature.

ripe. A pair of small baskets held face to face by a skewer and string are often used. In the jail garden at Baroda small perforated tin boxes are used, the lid and the box being of equal size and a slit cut in each to fit the stalk; the box hangs by the stalk of the fruit.

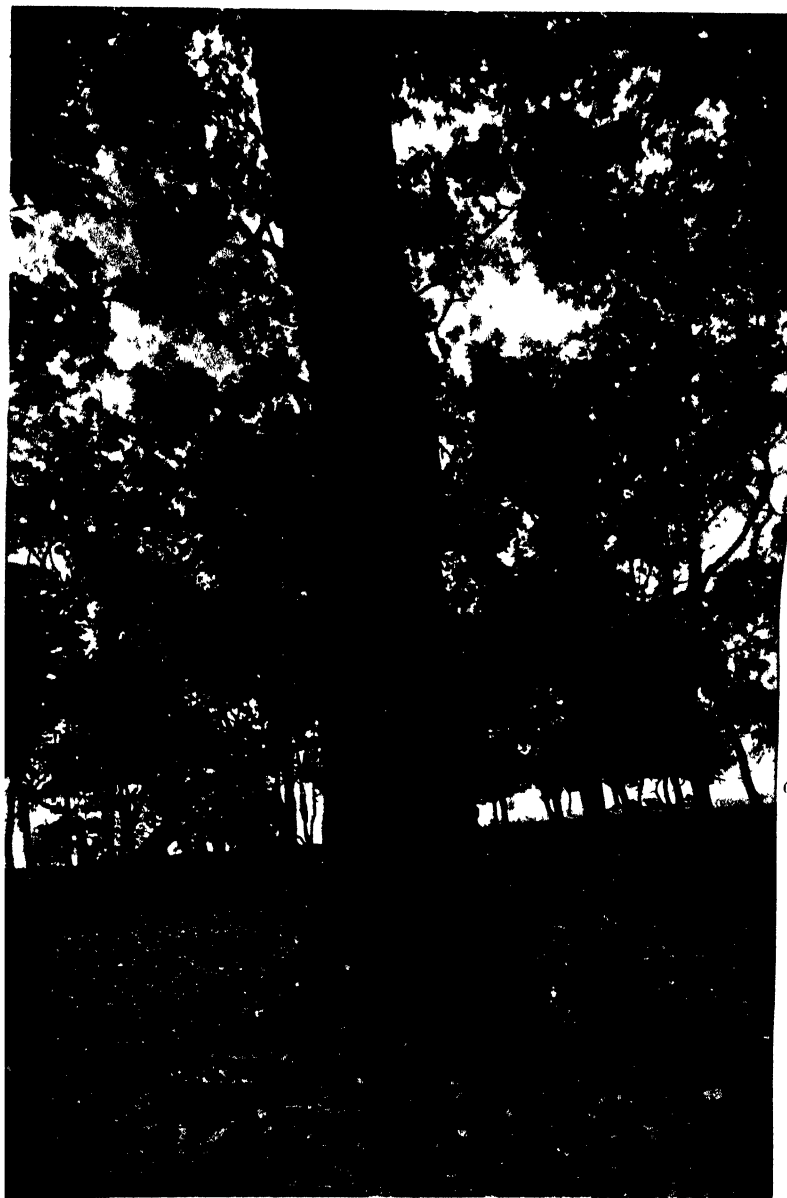
The Fig differs from the majority of fruits in being a hollowed out stalk, enclosing, while unripe, a large number of minute flowers and ultimately numerous small fruits, of which each may contain a solitary seed.

The variety cultivated in the Deccan is inverted conical, green at the base, deepening to brown at the apex, with alternating vertical stripes of green and brown, and $\frac{1}{2}$ lb. when well developed. By careful attention to resting and watering separate plots of trees the fruit-ripening season may be prolonged from October till August; the same plots, however, must be started into growth or sent to rest at the time selected, year after year.

The Fig affords sustenance to *Perina nuda* and several other destructive caterpillars, and hand picking is advisable.

BOEHMERIA NIVEA (*the China grass*)—*Rhea* (Assam), *Ramie* (Malay).—A Chinese herb, growing 6 feet high, with unbranched stems and yielding a good fibre from its bark. It grows well on rich soil in a cool, moist atmosphere without frost, such as occurs from 4,000 to 7,000 feet altitude in the Tropics, with abundant manure and yearly transplanting to fresh soil. Propagated by dividing the root-stock and by cuttings of the base of the stem. Its cultivation has been very successful in Tirhoot. There are two distinct named species: *Bohmeaia nivea*, with white underneath the leaves, and *B. tenacissima*, with green leaves—the latter is considered the better of the two.

FICUS KRISTNA.—A remarkable variety of wild Fig, which has the leaves turned backward and the edges joined so as to form a cup, with the upper side of the leaf forming the outside of the cup. Its treatment is humid air and heat with ordinary soil, the same as *F. myorense*,



NATURAL GRAFTING—FROM NATURE.

A wild fig—*Ficus bengalensis*—has germinated on a Mango tree, and sent its roots down to the earth. These roots have intergrafted abundantly.

of which it is probably a variety, as it greatly resembles that species in its fruit and branches. The propagation from seed of *F. kristna* will reveal its origin.

FICUS ELASTICA—*Attah bar, Kashmir, Kagiri, Nayangbawdi, Lesu, Yok, Ranket Rambong rubber (the India-rubber tree of Assam and Burma)*.—The sap of this handsome tree, collected by making cuts through the bark and dried by exposure to air in thin layers deposited one after another on a central matrix, somewhat as dip candles were made, is an important source of the valuable rubber or caoutchouc. As the demand for caoutchouc is advancing, the cultivation of this tree is important. It yields caoutchouc only in moist climates, and its profitable exploitation requires a mild tropical climate without extremes of temperature with about 100 inches of rain falling at short intervals throughout the year, and a rich soil not liable to long-continued flooding. Plants may be raised from seed collected in the small figs in Burmese or Assamese forests and sown on the surface of a heap of crushed bricks mixed with decayed leaves, shaded and watered gently at intervals short enough to keep the soil moist, but the seed does not germinate properly on ordinary soil. If cuttings are available, plants may be raised in a nursery and set out 15 feet apart, shaded and protected from wind until established. As a conservatory plant in a pot it is of easy culture, develops very large leaves, and lives a considerable time in the dry air and faint light of apartments.

MACARANGA PORTEUZA (from the Phillipine islands) is a magnificent small tree with entire leaves $2\frac{1}{2}$ by $1\frac{1}{2}$ feet on long stalks, and fixed near the centre. It thrives in turfy soil or good garden soil with stones to let in air.

LAPORTEA¹ **SCHOMBURGHII** **VERSICOLOR**.—A shrub with large, alternate, stipulate leaves on fleshy purple stalks, and irregularly mottled with patches of creamy

¹ *Laportea*, named by Gaudichaud in honour of his friend M. Laporte.

white. This shrub bears stinging hairs which cause severe, long-continued pain to certain individuals, but others are quite immune; it is not a desirable garden plant.

THE MULBERRY (of Cochin-China)—*Morus indica*, *Tut*, *Shah-tut*, and several other species—are widely distributed in gardens, and the essential for cultivation is a deep moist soil; well-flavoured fruit being obtainable in northern districts.

PELLIONIA¹ DAVEANANA.—A creeping plant suitable for a suspended basket or rock-work. Its leaves are alternate, stipulate, $\frac{1}{2}$ to $2\frac{1}{4}$ inches in length, oblique, roundish, elliptic, of a dark bronzy olive-green tinted with violet and marked by a broad central irregular band of bright green. It does well in rich loam kept open by a liberal mixture of cocoanut fibre.

PELLIONIA PULCHRA² has the upper surface of the leaves dull blackish along the midrib and veins.

PILEA MUSCOSA.³—A small herb, with minute orbicular opposite leaves and forming little fruits, which open with a sharp cracking sound, hence the name *pistol* or *artillery plant*. In conservatories it propagates itself freely and proves a charming edging plant in a moist climate or in a conservatory. It is propagated by cuttings, and valuable medicinal properties in *dysury* are ascribed to it.

STREBLUS ASPER—*Barinka*, *Sheora*.—A shrub or small tree well adapted for fences in a climate with heavy rainfall.

SYCOMOMORUS ANTIGONUM—the *Sycamore tree of Scripture*—grows in Madras gardens.

¹ *Pellionia*, in honour of A. M. J. Alphonse Pellion, an officer of *Freycinet's Voyage Round the World*.

² *Pulchra*, beautiful. *Pilea*, from *pilos*, a cap, alluding to the shape of the perianth segments.

³ *Muscosa*, musky.

CASUARINEÆ, *The Beefwood Family.*

CASUARINA EQUISETIFOLIA—*Kasrike, Chouk, Sinya, Kasurni, Aru.*—Is useful in forming nurseries, as its foliage is suitable for breaking the direct rays of the sun, but not excluding light. If planted in straight lines and thinned out as they develop, until the trees are 10 or 12 feet apart and the lower branches cut off, an excellent nursery may be formed with little trouble. The sandy beach at Bombay and Madras, rich alluvial on the river bank, or thin, decayed trap soil with abundant watering, at Poona, all rapidly produce good trees. It is reared from seed sown on moist, sandy soil; the wood is very hard and durable under shelter. The points of this tree are a good example of water pores.

SALICACEÆ, *The Willow Family,*

Is represented by a few river-side trees:—

SALIX TETRASPERMA—*Wallung, Pani-juma, Baishee.*—Occurs on the banks of hill streams near Mahableshtar and in Assam valley; and **S. BABYLONICA** is ornamental on the banks of a tank. Both are easily propagated by cuttings.

POPULUS EUPHRATICUS is similarly used in Sind and other northern districts.

CUPULIFERÆ, *The Oak Family.*

The **BRITISH OAK** *lives* at Mahableshtar, altitude 4,500 feet, and will probably thrive at higher altitudes.

The **CORK OAK** grew rapidly and died early at Ganesh Khind. At 4,000 to 6,000 feet, on Western Himalaya, it may be expected to grow profitably from seed.

CONIFERÆ, *The Cypress and Pine Family,*

Has a few representatives. A deep, loamy, well-drained soil with moving water at a depth of 6 feet are the conditions these trees enjoy. Propagation is effected by

seeds and cuttings. *Araucaria* seed does not bear the voyage, therefore plants must be imported or propagated from the upright growing shoots which appear when a tree has lost the leading shoot of the stem. If planted during autumn in a pot with a sandy soil and kept cool and moist in a close garden frame, roots will in due course appear, and the young plant may be gradually inured to sunshine.

ARAUCARIA.¹—The following species of *Araucaria* thrive in hot climates when planted on a deep, loamy, well-drained soil, regularly watered and enriched by dressings of decayed manure. Fresh manure is injurious if applied near the roots. If cultivated in pots, shade is desirable during the hot season. Propagated by cuttings of points in a frame.

ARAUCARIA EXCELSA—the *Norfolk Island Pine*—is in this climate the handsomest species. Its branches have a graceful feathery appearance.

ARAUCARIA COOKII resembles the last, but of more irregular outline.

ARAUCARIA CUNNINGHAMII is of very rapid growth and needs much protection from the prevailing wind; its whorls of branches are often 4 feet apart, and it prefers an altitude of 2,000 to 4,000 feet. This species is said to be increased by root cuttings.

ARAUCARIA BIDWILLII has triangular leaves about 1 inch in length. This is a delicate species in the plains in India, but thrives in a coir conservatory.

CRYPTOMERIA JAPONICA.—A grand coniferous tree, grows nicely near the road to Darjiling, from 3,000 to 6,000 feet altitude. It is propagated by seed and cuttings.

CUPRESSUS.²—Any rich garden soil well drained and watered, with 2,000 to 7,000 feet altitude south of Bom-

¹ *Araucaria*, from *araucanos*, its name in Chili.

² *Cupressus*, from *kuo*, to produce, and *parisos*, equal, with reference to the symmetrical growth of *Cupressus sempervirens*.

bay and proportionately lower in northern districts, suits this genus. Propagation is effected by cuttings or seeds collected in Northern India. Cuttings taken from the ends of branches and planted in sandy soil in October strike root freely. The varieties are not well defined, and the following list is only approximate:—

CUPRESSUS GLAUCA¹—*Suroo*.—Of very upright habit, with numerous short branches covering the stem. It is believed that this is an upright variety of *C. sempervirens*, analagous to the Irish Yew, which is an erect form of the common Yew.

CUPRESSUS SEMPERVIRENS.²—Foliage dark green, branches few and strong, forming an acute angle with the stem. Leaves ovate-oblong, convex, with a gland on each side.

CUPRESSUS SEMPERVIRENS HORIZONTALIS.³—Foliage pale green, branches numerous, spreading horizontally, rising at the points. The tree has a conical outline during the first twenty years.

CUPRESSUS FUNIBRIS.⁴—Foliage dark green, large branches ascending, the smaller compressed, pendulous, in two rows.

AGATHIS LORANTHIFOLIA.—In the Botanical Garden at Calcutta this has grown to a graceful tree. The soil is deep alluvium. This genus is propagated by fresh seed and cuttings.

THUYA⁵ **ORIENTALIS** forms a large spreading bush when it has room. China, Japan.

JUNIPERUS CHINENSIS.⁶—A dwarf conical bluish-green shrub of slow growth.

¹ *Glauca*, pale green.

² *Sempervirens*, evergreen.

³ *Horizontalis*, horizontal branched.

⁴ *Funibris*, funereal.

⁵ *Thuya*, from *Thuia*, the old Greek name used by Theophrastus.

⁶ *Juniperus*, the old Latin name used by Virgil and Pliny. *Chinensis*, from China.



CYPRESS TRIBE AT POONA.

Facing page 488.

JUNIPERUS.—A procumbent shrub, with bluish-green foliage.

PINUS LONGIFOLIA¹—*Saral, Chir, Chur Te, Dong, Gneit-kong.*—With needle leaves; is native in the dry districts of Himalaya from 1,500 to 7,000 feet altitude, lives in gardens at 2,000 feet altitude as far south as Bombay. At Calcutta and at Lahore good specimens of this fine tree occur in the public gardens.

PODOCARPUS CHINENSIS.—A small tree, having pale green, linear or lance-shaped leaves $1\frac{1}{2}$ inch in length by about $\frac{1}{8}$ inch. Firminger says it is of slow growth. A healthy specimen at Poona, at least twenty years old, is 4 feet in height. It is growing in an open border with occasional irrigation. It may be propagated by cuttings of the nearly ripened shoots in a close frame, and it is said to have root tubercles like *Leguminosae*.

FRENELA CUPRESSIOIDES forms a graceful shrub if treated as *Cupressis*.

SALISBURIA ADIANTIFOLIA—*the Maidenhair Tree.*—Has leaves like the Maidenhair Fern, and is interesting as one of the oldest types of vegetation at present growing in the world. It grows fairly with garden treatment at Lahore, and better on Himalaya about 2,000 to 5,000 feet altitude.

TAXUS BACCATA—*the Yew, Talis, Tingschi.*—Grows naturally on Eastern Himalaya from 6,000 feet altitude, and may be cultivated in slightly lower altitudes with a moist climate.

CEDRUS LIBANI—*the Deodor, Nashtar, Deodár.*—Grows naturally on North-Western Himalaya at 4,000 to 10,000 feet altitude, and is cultivated in all temperate climates. Raised from seed.

¹ *Pinus*, the old Latin name used by Virgil. *Longifolio*, long-leaved.

CYCADACEÆ, *The Cycad Family.*

A group of plants having large pinnate leaves surmounting a stout stem and resembling palms in general aspect, but the character of the fructification more closely allied to *Conifers*. "The female plants bear in the centre of the crown of leaves surmounting the stem a tuft of woolly pinnately cleft leaves on whose margins the naked or uncovered ovules are placed."—*Masters*. The young leaves are rolled up like ferns in the bud.

A rich loam with perfect drainage and water at short intervals suits those plants well. Propagation is chiefly effected by large bulb-like buds which appear at intervals on the stem and grow freely when taken off and planted in well-drained soil in a moist shady place. The sexes are on separate trees, and occasionally the female produces fertile seeds. Transplantation during the cold season may be effected without risk. Graceful specimens of *Cycas rumphii* are to be met with in the moist forests of Southern India. To remove these to a garden at a distance, it is advisable to cut off the leaves, and after clearing away as much soil as is practicable, to cut down the stem and pack it tightly in its own leaves, taking special care to protect the terminal bud. If this work is done during the cold season the stem will bear careful transport during two months without danger.

CYCAS MEDIA, from Australia.

CYCAS RUMPHII—*Bazur-batu, Todda-pana, Waragadu*—is of noble aspect with leaves of 5 to 8 feet in length having falcate pinnæ from 6 to 9 inches in length, dark shining green above and paler below. At Madras it is disfigured by a caterpillar which eats the leaves while in the large bud stage, and the remedy suggested is to enclose in mosquito netting to prevent the moth from laying eggs on the immature leaves. Southern India.

CYCAS REVOLUTA is of dwarf habit, with leaves much smaller than the above and with the margins curved backward. Japan.



GROUP OF CYCADS, AGAVE, AND YUCCA TREES,
AT POONA

Facing page 490

ZAMIA¹ **HORRIDA** is a dwarf species having the pinnæ lanceolate-acute, of a pale green and with spiny teeth on the outside.

MACROZAMIA CYLINDRICA, from Queensland, has dark green coriaceous leaves with glossy pinnæ, each marked at the base with an ivory white patch.

MACROZAMIA MACKENZII, from Queensland, has ovate leaves with narrow segments 9 to 10 inches in length set on the midrib, $\frac{1}{2}$ inch apart.

MACROZAMIA PAULI-GUILIELMI.—From an ovate stem with woolly scales rise erect spirally-twisted leaves with a flattened petiole and narrow linear leaflets 6 to 8 inches long, $\frac{1}{4}$ inch apart.

BOWENIA SPECTABILIS.—A dwarf plant of slow growth, having bi-pinnate leaves. It grows in a cool dry atmosphere.

MONOCOTYLEDONS, *One-Seed Leaf Class*.

The cultivation of this class, as a rule, is more easy than among *Dicotyledons*, because bulbous and tuberous plants prevail in it, and the root is fibrous without the tap root common in the broad-leaved division. The roots being fibrous and not usually penetrating to a great depth, necessitates extra preparation of the soil, so as to render it thoroughly friable and to intermix the manure perfectly. Among the bulbous or tuberous plants a season of complete rest is necessary, which may be obtained by withholding water. When the growing season returns, the bulb or tuber will generally show signs of growth and should be narrowly watched, as fresh potting or transplanting can be most effectually performed at this time. The bulb or tuber contains a supply of food on which the fresh growth draws for a short time, but soon new roots are sent out, and to obtain good development the

¹ *Zamia*, from *zemia*, loss or damage.

roots should have a supply of soil that has not been exhausted by previous growth, to draw sustenance from, hence the necessity of transplanting or re-potting at or before the beginning of the growing season.

ALISMACEÆ, *The Water-Plantain Family.*

A group of water or marsh plants having some highly ornamental species.

LIMNOCHÆRIS PLUMIERI has flowers in umbels on a triangular scape. It thrives especially at Calcutta, but, like other water plants, is capable of enduring a wide range of conditions if water be abundant.

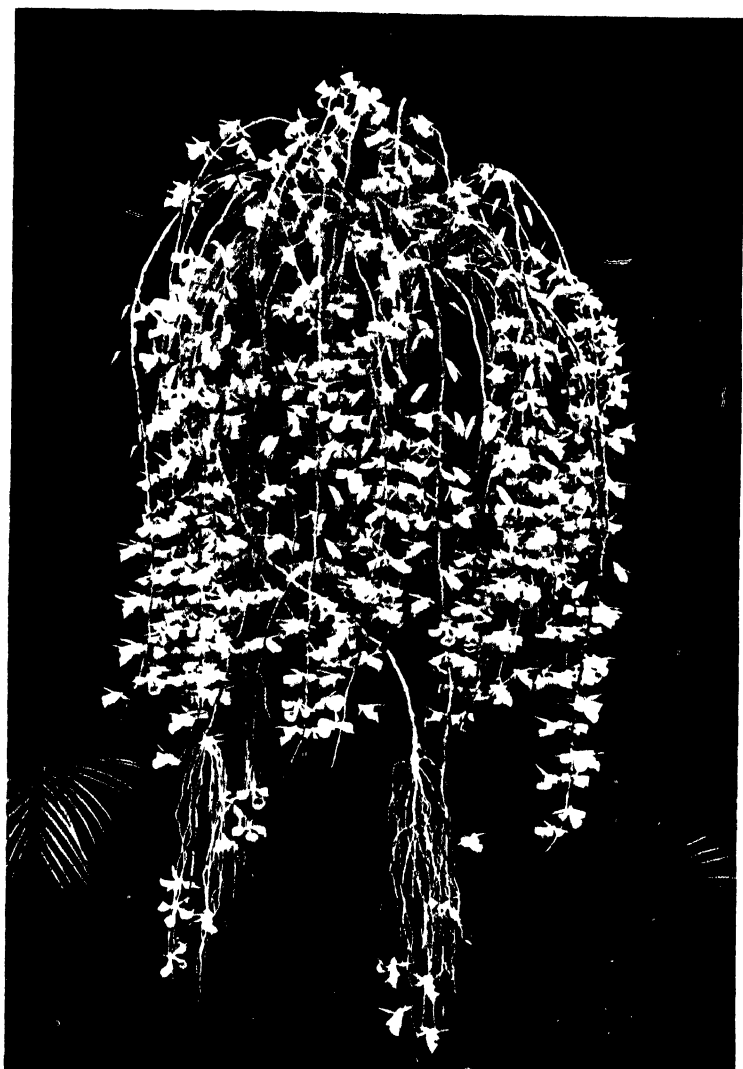
SAGITTARIA SAGITTIFOLIA has unisexual pure white flowers appearing in spring and arranged in whorls of three on an erect peduncle and radical arrowhead-shaped leaves, three- to five-nerved.

SAGITTARIA OBTUSIFOLIA has leaves obtuse at apex, or kidney-shaped, and numerous small white flowers appearing during the cold season. S. CORDIFOLIA differs in having heart-shaped leaves and racemes of 5 to 8 flowers.

BUTOMUS UMBELLATUS has abundant bisexual rose-coloured flowers grouped on the end of an erect peduncle and long linear radical leaves. It is propagated by division.

ORCHIDACEÆ, *The Orchid Family.*

In India we have some beautiful specimens of this charming tribe of plants growing profusely in the jungles. Districts having a moist atmosphere are their special home. Many orchids are epiphytal, living upon other plants, not by drawing nourishment from the sap of their hosts, but by clinging to the bark and taking shelter; nourishment is taken from the air, water, and the rain trickling over the decayed bark of the tree dissolves and brings with it some of the mineral matter the



DENDROBIUM PIERARDII.

tree had abstracted from the soil, or which is carried there as dust, and the dung of birds.

About a month before the monsoon sets in is the most suitable time to get orchids from the jungle. In collecting the plants, great care should be taken to have the roots unbroken, as they take a long time to recover, and meanwhile make no progress. When removed to a dry climate, they should be planted in pots having large holes in the sides to admit air, and filled with pieces of wood and charcoal, with a few decayed leaves and moss. Hanging baskets made of wooden spars are also excellent. Anything that will impede the free passage of water or air should not be put into the pots or hanging baskets. During the growing season, that is, from the beginning to the end of the monsoon, water should be given freely twice daily, and towards the cold season, gradually reduced until by January it has reached twice a week, at which rate the watering should remain until the monsoon again comes round. Shade from midday sunshine only is desirable, and the shade should be of a nature that will admit diffused light freely. For shade, thin cocoa fibre matting is excellent, as it is cool, light, and airy.

Some orchids are found growing in soil like other plants, and a friable loam, with about one-fourth part leaf-mould, is suitable compost. If taken from a jungle, it is advisable to transplant with a ball of earth, as disturbance of the roots may cause the death of the plant, though not for some weeks after moving; meanwhile the plant will continue growing from the store of sustenance laid up in its tubers, and the loss may be attributed to some other cause.

In connection with Orchids, a few special terms are used which it may be advisable to define:—

Epiphytal—adhering to, and growing upon, but not drawing nourishment from, other plants; *caudicle*—the small stalk to which the pollen masses are attached; *column*—the combination of stamen and pistil found in the centre of the flower, having one anther on the top

(except *Cypripedium*) and the stigma on the front; *lip*—a part of the orchid flowers which hangs downwards and is usually of a different colour from the remainder of the flower and generally has more showy tints—its purpose evidently is to attract insects, as it leads directly to the honey sac; *pollinium*—a mass of cohering pollen grains; *pseudo-bulb*—a swollen part at the base of the stem of many orchids; *rostellum*—the beak of the anther cover; *terrestrial*—growing on the ground, in contradistinction from orchids that grow on trees.

FERTILIZATION OF ORCHIDS.

In Europe one of the chief recommendations of foreign orchids is the long time the plants remain in bloom. The cause of this is—The stamens and pistils of orchids are joined together (*gynandrous*), forming a body called a column; the pollen is collected in masses (*pollinia*), and occupies a solitary anther which surmounts the column or two lateral anthers in *Cypripedium*. The stigma may be recognised as a glistening hollow spot on the front of the column, a little below the terminal anther. This structure renders extraneous aid necessary for the pollen to reach the stigma. To bring the required aid, honey is stored in a sac at the base of the column or the spur, so that an insect sucking the honey may bring its head into contact with the point of the anther cover (*rostellum*) and push it off, laying bare the pollen masses, which in many instances are furnished with an elastic stalk (*caudicle*) bearing a viscid disc presented at the front, so that on being touched it adheres to the head of the insect and is carried off to the next flower visited; there the mass of pollen comes in contact with the viscid stigma and is left adhering when the insect retires. Very often a particular species of insect is required for this work; therefore, when the plants are taken far from their native haunts the special insect is not available, and the flower remains fully open, standing expectant many days; from the same reason orchids in their own country being soon fertilised, retain their beauty only a short time.

ANÆCTOCHILUS¹ REGALIS—*Wanna-raja*.—A charming little plant with the leaves bronzed and netted with gold, found in moist mountainous districts at 4,000 to 5,000 feet altitude; thrives well in a small pot with a mixture of yellow loam and leaf-mould, having the small pot placed in the centre of a larger one, surrounded with coarse gravel, the gravel covered with moss and a bell-glass. Water should be given to the soil in the pot once in two days during the rainy season while the plant is growing, and the surrounding moss should be sprinkled with water daily; but during the dry season water once a week is sufficient.

ANÆCTO thrive at 3,000 to 4,000 feet altitude on Himalaya with shade, moist atmosphere, and temperature 70°.

AËRIDES.²—Epiphytes having long fleshy deeply channelled leaves arranged in two rows and variously toothed at the apex in a definite pattern useful for identification. In a few species the leaves are terete (the shape of a pencil) and the majority have handsome flowers. Among the fine sorts are—

AËRIDES CRISPUM.³—Flowers white, suffused with purplish-rose, nearly 2 inches in diameter, sepals and petals ovate-acute; lip three-lobed, the middle large, toothed at the base and fringed at the margin, and, as usually seen in India, the purple deepening to the apex, the side lobes small, erect, with purple striæ and the spur short incurved; leaves 4 to 5 inches in length, deep green, broad, flat, unequally two-lobed at the base.

AËRIDES CRISPUM LINDLEYANUM⁴ is a robust variety, sepals and petals white, lip large, rosy.

¹ *Anæctochilus*, from *anoiktos*, open, and *cheilos*, a lip, in reference to the spreading apex of the lip.

² *Aërides*, from *aer*, air, in reference to the power the species have of deriving their sustenance from the atmosphere.

³ *Crispum*, curled.

⁴ *Lindleyanum*, Lindley's.

ÆRIDES MULTIFLORUM.—Flowers rose, on branches sometimes 2 feet in length, sepals and petals equal, rounded at the apex, the lip sharply rhomboid, three-lobed, with a short spur; leaves light green, about 1 foot in length.

ÆRIDES MULTIFLORUM SUPERBUM has richer coloured flowers and a more compact habit.

ÆRIDES ODORATUM.¹—Sepals and petals creamy white, tipped with pink, lip cuculate with even side lobes, the middle lobe being ovate and inflexed; the spur conical and incurved, very fragrant, leaves oblique, obtuse, mucronate at the apex, and dark brown.

ÆRIDES RADICOSUM has deep rosy flowers in dense, erect, axillary, oblong racemes, about 6 inches in length, sepals and petals ovate, lip linear, with a long, slender, compressed spur; leaves dark green, thick, linear, slightly channelled, 3 to 4 inches in length, two-lobed at the apex; stem 8 to 10 inches in height.

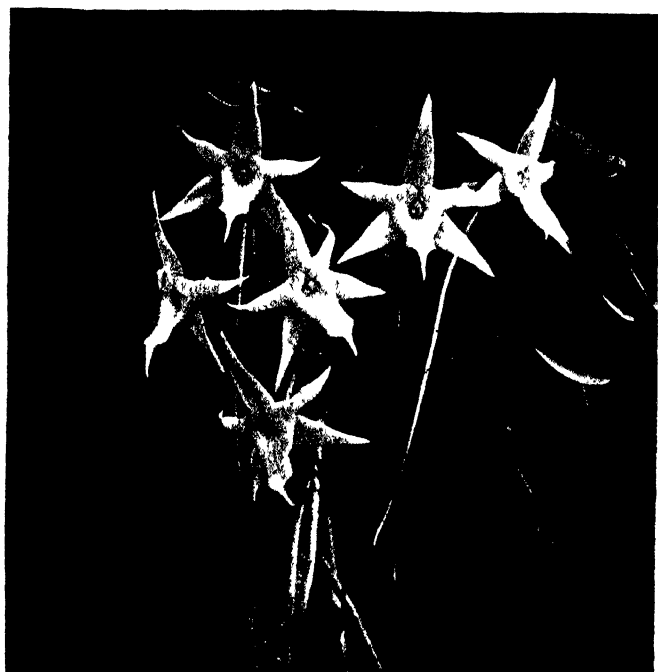
ANGRÆCUM SESQUIPEDALE.²—An orchid from Madagascar, having ivory-white flowers 5 to 6 inches in expansion with a long pendulous spur, produced freely during the cold season. It thrives in conservatories in warm, moist districts, if protected from the sea breeze and hot dry wind. A hanging basket of wooden spars containing pieces of charcoal, cocoanut fibre, and moss suits it, and watering twice daily with a spray during the hot weather and also during the rainy season, unless the rain be heavy. While in flower, watering over the dry root only, at intervals of three days, is sufficient.

BLETIA VERECUNDA.³—A terrestrial fragrant orchid, having lanceolate folded, erect or recurved leaves 18

¹ *Odoratum*, fragrant.

² *Angræcum*, from the vernacular name. *Sesquipedale*, 1½ foot, referring to the length the spur attains.

³ *Bletia*, in honour of Don Louise Blet, a Spanish botanist.



ANGRÆCUM SESQUIPEDALE.

inches in length, from small pseudo-bulbs and purple flowers in profuse racemes well above the leaves. It needs abundant water during the growing season and a short supply while at rest during November to January. This is recorded as the first tropical orchid that was cultivated in England, about 1733.

BLETIA SHEPHERDII, resembles the above, but is distinguished by a yellow line in the centre of the lip.

CALANTHE.¹—Terrestrial orchids have large ribbed and plaited leaves, with few exceptions evergreen, and producing long spikes bearing many flowers, with the spurred lip attached to the column and eight waxy pollen masses adhering to a separate gland.

CALANTHE MADAGASCARIENSIS is a salt species with the lip first violet then changing through yellow to crimson.

*CALANTHE VESTITA*² is deciduous, and thrives well on a raised bank of rich soil slightly shaded; it produces its pure white flowers in a nodding spike during the cold season.

*CALANTHE VERATRIFOLIA*³ has broad many-ribbed leaves with wavy margins and flower spikes, attaining 2 or 3 feet in height, with many flowers, pure white in colour, except the green tips of the sepals and golden papillæ on the lip. It is a native of moist districts in Northern India, and in conservatories in the plains may be had in bloom almost throughout the year. A loamy soil enriched with leaf-mould, and steady watering, except during three months by preference in the hot season, when it should be kept slightly dry, to go to rest practically. By keeping a succession of plants in a dormant condition at various times, the blooming season may be prolonged. It may be propagated by dividing the stock.

¹ *Calanthe*, from *kalos*, beautiful, and *anthos*, a flower.

² *Vestita*, clothed.

³ *Veratrifolia*, having leaves like *Hellebore*.

CATTLEYA.¹—Orchids having pseudo-bulbs bearing one, two, or rarely three leaves. The most elegant have only one leaf on each pseudo-bulb. The flower scape rises from the top of the pseudo-bulb and bears a few flowers of large size, rich colours, and having four pollinia. Several species are cultivated with success at Calcutta in well-sheltered conservatories kept moist by continual damping of the floors and stages. Suspended shallow pans containing a mixture of cocoanut fibre, moss, and sand with carefully arranged drainage are used, and water is given from the watering-pot rather than the syringe, in order to avoid the retention of water by the sheathing scales which envelope the young growth.

CATTLEYA LABIATA (of Brazil).—Its flowers measuring 7 to 8 inches broad and 9 to 10 inches deep; the sepals and petals pale rose, and the lip large and broad, of a rich deep purple or violet in front, and having a large, yellow eye-like blotch on each side of the throat.

CATTLEYA MENDELII, a very fine species from Columbia; the sepals and petals are large and broad, varying in colour from white to a light pink, and the lip is large and rich magenta.

CATTLEYA PERCIVALIANA.—The sepals and petals are deep blush, the lip much fringed, intense magenta-crimson, margined with blush-pink; the throat richly marked with crimson and golden-yellow lines. It blossoms well in this country.

CATTLEYA LUDDMANNIANA (of Venezuela).—The stems are oblong and deeply channelled, each having an ovate, shining leaf; flowers 8 inches across, two or three together in a short spike. Sepals and petals broad, soft flesh colour, changing to mauve with age.

¹ *Cattleya*, named in honour of William Cattley, Esq., of Barnet, Herts, a famous patron of botany, and one of the most ardent collectors of rare plants of his day.



CATIPYA LABIATA

The illustration is from a photograph, by Mr Lane, of a plant in Calcutta Botanic Gardens, and shows the method adopted to preserve the flowers from the attentions of Beetles,—cotton soaked in phenol being tied round the stems

CATTLEYA WARNERI.—The flowers are 6 inches across; the sepals and petals rosy, the lip large, rich crimson, and fringed.

CÆLOGYNE.¹—Epiphytal pseudo-bulbous orchids having large, coloured, membranous flowers, with converging and slightly spreading sepals, petals of like nature, but narrower, a great cucullate lip usually bearing fringes on its veins, and a broad membranous column. Many are from Nepal, where they are frequently covered with snow in the winter.

CÆLOGYNE FLACCIDA (from Nepal).—Having a pair of dark green leathery leaves from the top of a pseudo-bulb, and a pendulous spike of white flowers of thin texture, having the lip streaked with crimson at the base and pale yellow in front. It thrives in a suspended pot having side holes, and filled with a mixture of potsherds, pieces of bark, and leaf-mould, with a covering of moss, and kept in a moist conservatory.

CÆLOGYNE CORRUGATA² (of Southern India), has sepals and petals pure white, with a yellow spot in front and veined with orange; racemes are erect, and shorter than the leaves.

CÆLOGYNE CRISTATA (of Himalaya), has the sepals and petals snow-white; the lip white, with a blotch of yellow in the centre, the veins with a golden crest-like fringe, the leaves twin, narrow, leathery, dark green, on oblong smooth pseudo-bulbs.

CÆLOGYNE ODORATISSIMI³ (of Nilgheri Hills and Ceylon) is pure white, excepting the centre of the lip, where it is stained with yellow; the raceme is slender, pendulous, the leaves twin, pale green, lanceolate, about 4 inches in length.

¹ *Cælogyne*, from *kóilos*, hollow, and *gynē*, female, in reference to the female part or pistil.

² *Corrugata*, wrinkled.

³ *Odoratissimi*, very sweet-scented.

WHITE CŒLOGYNE (from near Kursiong), abundant at 5,000 feet altitude.

CYMBIDIUM.¹—This genus grows in clefts in trees and such places where there is an accumulation of dead leaves, therefore it is intermediate in character between terrestrial and epiphytal orchids, and needs a soil consisting of rough loam, pieces of bark, and broken pots in equal parts. The pot should have a large hole in the bottom and be suspended.

CYMBIDIUM ALOIFOLIUM² (of Southern India and Ceylon), has large flowers of a rich purple, with a long, almost black, strip down the centre; the spikes are sometimes 4 feet in length and drooping.

CYMBIDIUM EBURNEUM³ (of Himalaya), has its flower spikes upright, its sepals ivory white, petals and lip stained with pale yellow.

CYMBIDIUM PENDULUM (of Himalaya), has the sepals and petals brown, lip red, striped with white, racemes drooping, attaining 2 feet in length, many-flowered, leaves long, narrow, erect, leathery, dark green.

CYPRIPEDIUM⁴—*Lady's Slipper*—are terrestrial orchids having two lateral stamens and the labellum forming a large inflated pouch and the pollen immersed in a viscid fluid. The plants thrive in rough loam and leaf-mould or decaying wood in ordinary pots well drained and kept in a cool moist place. Very many hybrids of this genus are cultivated in gardens.

CYPRIPEDIUM CONCOLOR, flowers pale yellow, thrives in a mixture of soil, moss, and leaf-mould in conservatory.

CYPRIPEDIUM VENUSTUM has short, spreading, dark bluish green leaves, mottled and blotched with paler

¹ *Cymbidium*, from *kymbe*, a boat, referring to a hollow recess in the lip.

² *Aloifolium*, aloe-leaved.

³ *Eburneum*, ivory.

⁴ *Cypripedium*, from *kypri*s, Venus, and *podium*, a slipper, lady's slipper.

green and pale purple on the lower side, and solitary flowers having the sepals and petals greenish white or pink striped with bright green, the petals fringed; the lip yellowish green. It flowers freely during the cold season. Himalaya.

DENDROBIUM.¹—This variable genus is easily cultivated in suspended spar baskets containing pieces of charcoal and half-decayed leaves in equal proportion and covered with moss. Frequent watering during the rainy season and a distinct rest in a cool moist atmosphere during the cold season are suitable. The leaves are nearly all ovate, elliptic, pointed, and generally produced on long slender stems.

DENDROBIUM AGGREGATUM, of N. India, has deep yellow flowers borne in arching racemes six inches in length during the hot season. Pseudo-bulbs are thick, deep green, and bearing a solitary leaf. The plant without the flowers is 3 to 4 inches in height.

DENDROBIUM ALBO-SANGUINEUM² (of Burma), has soft creamy-white flowers about 4 inches across, produced during the hot season; petals are twice as broad as the sepals, white, with a few blood-red streaks at the base; labellum with a large reddish-crimson blotch in the middle; the pseudo-bulbs are from a few inches to 1 foot in length and nearly 1 inch in diameter.

DENDROBIUM AQUEUM³ (Southern India), has creamy-white flowers, solitary or in pairs, rising from the axils of the leaves at the end of the rainy season; lip recurved from the middle, ovate, rhomboid, obscurely three-lobed, two lateral small lobes, the intermediate one triangular; the lower half has an elevated ridge and under its termination a depression, and that part has a deep yellow blotch; the under-side smooth, the upper downy and

¹ *Dendrobium*, from *dendron*, a tree, and *bios*, life; the species are epiphytal in their native habitats.

² *Albo-sanguineum*, white and crimson.

³ *Aqueum*, watery.

striated, the margin of the terminal lobe fringed with soft hairs; the leaves are in two ranks, ovate, the upper smaller and lance-shaped, all very thin, suddenly pointed and striped with longitudinal nerves; stem stout, yellow-green, compressed, striated, and leafy while flowering.

DENDROBIUM AUREUM¹ (of Tropical Asia), has amber, fragrant flowers produced during February in groups of four to six from the nodes of two-year old pseudo-bulbs 1 to 1½ feet in length and ¼ inch in diameter, the lip is amber-coloured with brown and purple markings.

DENDROBIUM BENSONIÆ (of Burma).—Snow-white, with a broad stain of yellow on the disc and two purple blotches near the base of the lip.

DENDROBIUM BARBATULUM²—*Jadia-lasan* (of India) has flowers 1 inch in width, ivory-white with a slight tinge of pink, and produced in dense erect racemes from leafless pseudo-bulbs 1 foot in length.

DENDROBIUM CRYSTALLINUM.—A Burmese species, having the sepals and petals white, tipped with purple, and the lip white, with orange at the base and purple on the tip. The pseudo-bulbs are 1 to 1½ inches long and ½ inch diameter.

DENDROBIUM CRYSTOXUM.—Has pseudo-bulbs 1 inch long and 1½ inches diameter; flowers over 1 inch across in a drooping raceme 6 by 12 inches; sepals and petals pale yellow, lip a deeper yellow. An evergreen Moulmein species.

DENDROBIUM CRETACEUM³ has during the hot season flowers chalky-white, solitary, from the joints of long leafless stems, small, downy lip, with a pale yellow disc pencilled with crimson, margins ciliated; pseudo-bulbs 8 to 14 inches in length by ½ inch in diameter, a compact pendulous species.

¹ *Aureum*, golden.

² *Barbatulum*, small-bearded.

³ *Cretaceum*, chalky.

DENDROBIUM DALHOUSIANUM.—Evergreen, flower 3 to 5 inches in expansion, in colour buff, shaded with pale lemon, lip of the same colour, spotted with two large blotches of dark crimson and margined with rosy-pink; racemes drooping, six- to ten-flowered, produced from the growth of the previous year during the hot season; pseudo-bulbs stout, erect, 3 to 5 feet in height, about 1 inch in diamer, having purple lines running the entire length.

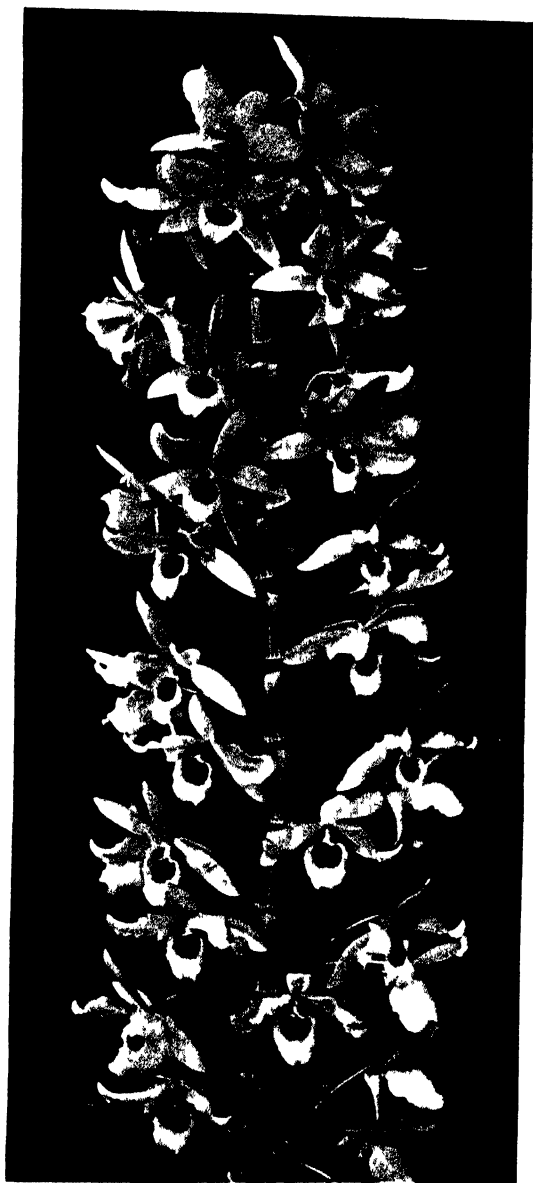
DENDROBIUM FARMERI.—Upright, evergreen, about 1 foot in height; stems club-shaped, and bear several shining dark green leaves towards the top; sepals and petals pale straw tinged with pink, and the disc of the lip golden yellow.

DENDROBIUM FINLEYANUM (from Moulmein), has pseudo-bulbs 1 foot high in egg-shaped nodes 1 inch by $\frac{1}{2}$ inch. The flowers are 2 by 3 inches across, the sepals and petals white, tipped with pink, the lip white, with a large orange blotch on the anterior part.

DENDROBIUM FORMOSUM has white flowers of much substance, 4 to 6 inches in expansion, produced from the point of the pseudo-bulb, during the hot season; the lip white, with an orange throat. The spikes are three- to eight-flowered, the pseudo-bulb 1 to $1\frac{1}{2}$ feet in height and 1 inch in diameter, and bearing eight to ten leathery leaves.

DOSSINIA MARMORATA (from Borneo) is one of the beautiful-leaved small Orchids. Under a "bell-glass," or inverted old-fashioned lamp which keeps out the hot wind and shade, with light, the plant thrives with light mossy soil and watering about once a week.

DENDROBIUM NOBILE (from China and Northern India).—Evergreen, flowers fragrant, white, tipped with rosy-pink; lip white, rosy-pink in front, blotched at the base with deep velvety crimson. Pseudo-bulbs 2 to 3 feet in height and $\frac{1}{2}$ inch in diameter, bearing ten to sixteen bright green leaves.



DENDROBIUM NOBILE.

DENDROBIUM NODATUM.—An erect deciduous species, from the cool parts of Moulmein, with pseudo-bulbs 4 to 8 inches high and $\frac{1}{2}$ inch diameter through the nodes. The flowers are amber-coloured, the lip bright orange, margined white, and with a blood-red spot at the base.

DENDROBIUM PARISHII.—A semi-erect, deciduous species, which thrives in conservatories at Calcutta and also at high altitudes, bearing flowers purplish-rose fading into white towards the centre, generally twin; lip shorter than the petals and petals woolly rosy with two eye-like purple blotches in the centre; pseudo-bulbs 8 to 14 inches in length and $\frac{1}{2}$ inch in thickness, enveloped in thin epidermis.

DENDROBIUM PIERARDII has flowers creamy-white or delicate pink with a primrose lip and produced on long pendulous stems 2 to 4 feet in length and $\frac{1}{2}$ inch in thickness. A native of Northern India, it thrives beautifully in conservatories from sea-level to high altitudes.

DENDROBIUM REGIUM (of India).—A deciduous species, having flowers $2\frac{1}{2}$ inches wide, light purple-rose with darker veins, a creamy zone near the centre, and the tube of the lip yellow.

DENDROBIUM THYRSIFOLIUM (of Burma).—Flowers yellow, in suspended thyres during spring.

DENDROBIUM BRYMERIANUM (of Burma) has orange flowers with the lip very much divided.

ERIA BRACCATA.—A small Orchid of the Western Ghats, near Khandala; pseudo-bulbs $\frac{1}{2}$ inch in breadth and in the centre $\frac{1}{4}$ inch in depth; leaves two, elliptical, $2\frac{1}{2}$ inches by $\frac{1}{2}$ inch. Flower 2 inches in expansion, white, with a yellow spot on the lip; solitary, on a slender stalk 3 inches in length, produced abundantly.

EULOPHIA NUDA.—Is a native of India, from Nepal to Ceylon; it occurs in moist parts, is a terrestrial species, very variable in colour, from green to pink; has plaited leaves rising from the ground, and flowers in a spike.

EULOPHIA PRÆTENSE.—Terrestrial, having lance-shaped, plaited leaves, 1 foot by $\frac{3}{4}$ inch, rising from the ground, and flowers about 1 inch in expansion, greenish-yellow on the inside and brown on the outside, in erect racemes. This pretty Orchid is found in moist places in the Deccan, and when carefully transplanted flowers freely during December on moist borders having a northern exposure.

MACODES ROLLISONIA and **M. JAVANICA** are both of Java, and beautiful-leaved small terrestrial Orchids, which thrive if kept under a glass globe in shade, with light and a mossy soil ; water about once weekly.

ODOTOGLOSSUM PESCATOREI (of Columbia).—An Orchid enjoying slight shade and a hot, moist climate ; growing on wood with daily watering.

PHALÆNOPSIS.¹—Epiphytal, having a short stem, no pseudo-bulbs, a few broad, thick, leathery leaves notched at the tip and showy racemose flowers.

PHALÆNOPSIS AMABILIS² (of Malaya).—This lovely Orchid presents no special difficulty in the moist districts. A hanging basket formed of spars about 1 inch square and 1 foot long fastened together by running a wire through holes in the ends is well suited for it. The basket may be filled with large pieces of charcoal, potsherds, and moss, and the plant kept where the air is moist and protected from direct sunlight and watered freely throughout the year. The varying degrees of natural moisture available in the air at different seasons is sufficient to give it the alternating seasons of growth and rest necessary. The flowering season may be extended almost throughout the year if a number of plants are kept under different treatment as regards heat and moisture, but the greater number of plants of this Orchid blossom during February to April.

¹ *Phalænopsis*, from *phalaina*, a mouth, and *opsis*, resemblance, referring to the appearance of the flowers.

² *Amabilis*, lovely.

PHALÆNOPSIS SCHILLERIANA (the Phillipines).—Has leaves marbled and mottled with light green on a rich green ground, the flowers of rosy tint varying in intensity (produced from February to June) and the roots fattened and rough. It thrives nicely in conservatories at Calcutta.

PHALÆNOPSIS ROSEA (of the Phillipines) has oblong leaves, slightly broader at the apex, and flowers white, tinged with pink and having the lip deep violet in the centre and slightly tinged with orange on the side lobes.

PHAIUS WALLICHII (of Himalaya and Assam).—Large, terrestrial, with folded lance-shaped leaves from a short stem and erect spikes of flowers shading from white to crimson-brown. It thrives planted out on a bank of rich soil kept moist during the growing season and shaded from direct sunshine only, and flowers in January and February. A most excellent conservatory plant.

PHAIUS ALBA belongs to a different section of the genus, and is often called *Thunia alba*, and differs much in appearance from the above, resembling a *Dendrobium* more in habit and appearance, but distinguished by the stem growing 1½ feet in length furnished with two rows of sword-shaped, sharp-pointed leaves having three nerves and large white bracts which enclose its pure white flowers measuring 2½ inches in width, of which three or four appear at the end of the branch in August. Forests on the Western Ghats are its home.

PLATANThERA¹ **SUSANNÆ**.—A *Nagchora* terrestrial Orchid, found in hilly districts with heavy rainfall; the stem attains 3 feet in height and bears ovate, oblong, acute leaves, the upper ones sheathing, and large white fragrant terminal flowers having the lateral lobes of the labellum deeply fringed.

POGONIA PULCHELLA (of Hong Kong).—A tuberous Orchid, having a scape about 5 inches high on which are

¹ *Platanthera*, broad-flowered.

a few flowers, and later a single 14-ribbed leaf of cordate outline and colour in which brown shades off to white between the ribs and white specks all over the leaf on the lower side; the leaves are rose, and bear hooked hairs on the ribs. A shaded orchid-house and a soil consisting of $\frac{1}{2}$ broken bricks, $\frac{1}{4}$ soil, and $\frac{1}{4}$ dead leaves, with abundant water during the growing season; and *P. CARINATA*, having many-flowered scapes. Are interesting plants found at Lanowli.

RENANTHERA COCCINEA.

RENANTHERA ARACHNITES.

*RHYNCHOSTYLUS RETUSA*¹ is an epiphyte, abundant at the base of the Western Ghats and hot moist districts from Himalayas to Ceylon, having two ranked leathery leaves 1 foot in length and 1 inch in breadth, channelled, unequally three-toothed at the apex, longitudinally striped with light and dark green, and having the sheathing part of the base dark green and adherent to the stem. The flowers are white, striped, or spotted with violet-pink and produced in dense cylindrical drooping or pendulous racemes. It produces flattened roots which descend the stem of the tree and luxuriate among decayed leaves on the ground. Formerly *Saccolobium guttatum*.

STANHOPEA EBURNEA.—An Orchid from Tropical America, which thrives in the Botanic Gardens, Calcutta; has ivory-white fragrant flowers which open suddenly with a loud flop. It is grown in a suspended basket of wooden spars which permit the flowers to come through the bottom. Cocoanut fibre, moss, and pieces of bark for soil, a moist atmosphere, and abundant water during the growing season are necessary for its cultivation.

VANDA.²—Epiphytal Orchids with showy, fragrant flowers, and thriving with more exposure to the sun than

¹ *Rhynchostylis*, from *rynchos*, a beak, and *stulos*, a pillar, alluding to the shape of the column. *Retusa*, retuse.

² *Vanda*, the original name of an Indian species.

Orchids generally need ; the stems are leafy, not pseudobulbous; the leaves are two-ranked, spreading, or sometimes terate. Abundant water during the rainy season and a cool moist atmosphere with occasional syringing during the season of rest suits them. May be fastened with some moss to an upright post wedged into a pot with pieces of charcoal and potsherds.

VANDA HOOKERIANA (of Malaga) has flowers $2\frac{1}{2}$ inches in expansion, sepals white, tinted rose, and petals large, white, spotted magenta, undulated, oblong, the lip wedge-shaped, at base three-lobed, $1\frac{1}{2}$ inches broad, white, lined and spotted magenta-purple, and having a large deep purple auricle on each side of the column. The leaves are 2 to 3 inches in length, terete, pale green, and pointed.

VANDA TERES¹ resembles the above, but is more straggling in habit.

VANDA ROXBURGHII (of India) has sepals and petals pale green with checkered lines of olive-brown, oblong, ovate, the outer surface white, the lip violet-purple, convex in the front part, deeper purple towards the apex, the lateral lobe white, lanceolate, the spur pinkish, short; racemes six- to twelve-flowered on erect peduncles. Leaves tongue-shaped, recurved, channelled, leathery, and obliquely three-toothed at the apex.

VANILLA.²—This much-valued flavouring substance is the cured fruit of a climbing Orchid, *Vanilla planifolia*, found wild in Mexico, and cultivated in hot moist climates such as Seychelles, Java, and moist parts of Ceylon and Florida. As a conservatory plant, it is of easy culture throughout our limits; but as a commercial product, requires a hot, equable climate, with rain almost throughout the year, about two months' comparatively dry

¹ *Teres*, terete, or slender and smooth with a circular transverse section.

² *Vanilla*, from the Spanish *vainilla*, a little sheath, in allusion to the shape of the fruit.



VANDA TERES.

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weather being necessary to bring the plant into bloom, especially in the moist parts of Mexico and the Seychelle Islands, whence, after curing, it is shipped from August to December. A climate similar to that in which Pepper or Cardamons thrive is suitable, and irrigation during a part of the year may be used to supplement the rainfall. Hot dry wind and stagnant water in the soil must be avoided. A rich loamy soil with gentle slopes and bearing a coating of vegetable matter such as is found in forests is specially suitable, but *Vanilla* thrives on sand if heavily manured with leaf-mould, and does not object to stiff soil if opened up with half-decayed leaves and small twigs. In a fairly open forest, lines 5 feet apart, of posts formed of any convenient tree that will root, such as *Pangara* (*Erythrina indica*), inserted about 10 feet apart, the posts being by preference 5 feet above ground and with a fork near the top in which the vine may rest, and bambus or cords may be run to support the trailing growth during the first season.

Cuttings are planted any time during the wet season, and the larger the cutting the sooner will produce be obtained; from 1 foot to 12 feet in length may be used, but cuttings of one length only should be planted in one part of a plantation, so that the plants may all fruit together; the first year the vine should be trained up its tree and along the bambu or cord, the flowering branches will hang from the original vine and produce abundant flowers near the end: these branches need to be cut back yearly. To induce flowering, it is sometimes advisable to withhold manure; but this is a local detail, not necessary unless the rainfall be continuous.

Leaf-mould is the most suitable manure, and the frequency of its application will depend on the nature of the soil: sandy soil may have three doses yearly, but in any case, a liberal supply while the plants are in bloom is desirable. As the plants are surface-rooting, the manure may be laid on the surface. When the greenish-white flowers appear, pollination is necessary. To *learn* how to do this: Take off two fresh flowers, strip from each

the five petals and the encircling lip, leaving only the column in the centre, pass the finger-point gently round the upper part of the column, a touch will cause the anther cover to fall off, showing two granular masses of pollen which will adhere to the finger; now take the other flower—on the front of the column, just beneath the anther, may be seen a shining transverse space, the stigma—apply the pollen, part of it will adhere, take the pollen from this flower and apply it to the stigma of the first, and the essentials being acquired on mutilated flowers taken *off* the plant, skill will come by practice in the natural position of the flower; the pollination of, and the removal of its own pollen from a flower, is done simultaneously by an upward stroke of the bambu slip or by a camel hair pencil. All the flowers need not be fertilised, as the plant would not be able to develop so much fruit, and it is advised to fecundate only the lower flowers on the flower-shoot, because the fruit will then hang downward without bending. A slip of bambu or camel hair pencil will be found more convenient than the finger tip in conveying the pollen from the anther to the stigma.

The pod takes about eight months to mature for gathering, and the curing is an important and delicate operation. The pod must be ripe, but not open—if open more than $\frac{1}{2}$ inch, it is useless. When gathered, the pods are packed in banana leaves and a blanket and placed in an oven that has been heated to 140° F. and the fire withdrawn and allowed to cool slowly to 90° F., then the pods are taken out and arranged on boards covered with flannel and exposed to the sun (some cover the pods with black flannel to get the advantage of the absorption of heat), and after two or three days, when a brown or coffee colour has been attained, the pods are arranged on wicker-work trays and kept in an airy room and allowed to dry slowly for about a month; afterwards, the pods are arranged in sizes, fifty pods 8 inches in length weigh about $\frac{3}{4}$ lb., such are packed in tins and sent to the market. Such is an outline of one method of curing;

there are many in practice, and another may be found in full detail in the *Journal, Agri.-Horti. Soc. of India*, Oct.-Dec., 1902.

Vanilla is subject to a fungus—*Calosporae vanillae*—which appears as subgelatinous orange specks on the fading leaves. Faded and dead leaves should be burned to prevent it from spreading.

SCITAMINACEÆ,¹ *The Ginger and Arrowroot Family.*

An important group of herbs, some of large size (*Banana*), others important condiments (*Ginger*, *Tumeric*), and a few highly ornamental (*Alpinia*, *Canna*). To grow any large herb successfully, an extremely rich soil and abundant water are necessary, and in this family the produce is proportionate to the leaf development that has been duly exposed to light. Therefore, a rich soil with the necessary water, planting sufficiently thick for the plants to protect each other, yet not thick enough to prevent access of light, are important considerations. Propagation very easily by division of the root-stock. Seeds of this family are generally tardy in germination; but, if mixed with cow-dung and water and exposed to sunshine until swollen, will germinate quickly.

ALPINIA NUTANS—*Panag-champa*.—An herb attaining 5 to 6 feet in height, bearing its leaves in two rows on the upper part of the stem and at its apex a drooping raceme about 1 foot in length of flowers deep orange-yellow on a dark crimson ground and most elegant form, the flowers appearing a few together in the axils of pure white refulgent bracts having rosy tips. It needs a very rich moist soil, and the banks of a tank is its natural habitat; but to enjoy the full beauty of this plant strong young “roots” should be potted with rich, sandy soil, and, after growth is established, regularly supplied with

¹*Scitaminea*, from *scitamentum*, a delicacy, alluding to the numerous delicacies produced by the family.

liquid manure, the pots being kept in saucers to retain water. The plants may be used while in flower for the decoration of apartments, and planted out as soon as the bloom is past.

ARROW-ROOT—*Maranta arundinacea*.—This crop thrives in a variety of soils and with variable degrees of rainfall; in dry districts irrigation is necessary, but with a rainfall of 80 to 100 inches watering is only necessary for the nursery beds. The ground is prepared as for Sugar-cane, by heavy manuring and ploughing often enough to produce a fine tilth, and in irrigated planting the green shoot is pressed into the newly-watered furrow with the naked foot. In the districts with abundant rainfall the small end of the "root" is cut off and planted close together near a well, whence they are removed when the monsoon has come, and planted in fields in lines 2 feet apart, about 15 inches separating the plants in the line. In January, the crop is ready to lift; the produce is generally about 6 to 7 tons per acre—over 12 tons per acre were produced at Poona—and the proportion of pure starch obtained is about 10 per cent. of the weight of the roots. The starch is prepared by pounding in a mortar and washing in water, and no iron implement may be used, otherwise discolouration of the starch ensues. A white variegated form is common in gardens under the name *Phrynium variegatum*.

MARANTA.—This genus has a large number of species and varieties of ornamental-leaved herbaceous plants, of easy culture in rich friable soil in conservatories; some are evergreen, producing new leaves some time before the older ones decay, others are deciduous, and when without leaves need to be kept dry.

THE BANANA (*Musa sapientum*).

The superior varieties of the Banana, such as the Golden or the Red Banana, when in proper condition, are perhaps the most generally satisfactory fruits known; the flavour is delicious, yet not cloying, and

one may always return to the Banana with relish; and the cleanly conditions under which it is eaten is no slight recommendation to its use. Most of the varieties of Banana are completely seedless; the rudimentary seeds or ovules may be observed as little black specks on the cross section, and their number is so great that when the seed is developed the whole fruit contains little else. The uncultivated relation of the Banana, which lives on the Western Ghats—*Chöinie*, *Musa superba*—and other hill ranges, has abundant seeds, each as large as a pea; so has the Manilla hemp plant, a great herbaceous plant resembling the Banana; and if these be cultivated in the same garden with the Banana, a few seeds appear in the usually quite seedless fruit. Heat and moisture, both in a high degree, are necessary in growing the Banana, but if hot wind be excluded, the moisture may be produced by irrigation to the extent of $1\frac{1}{2}$ inches of water over the ground, once weekly. Shelter from wind from all directions is a serious consideration in Banana cultivation, and restricts the production of the fruit greatly: the finest sorts are both tall and weakly in the stem, and half a gale of wind will break every stem in a field unless the shelter be perfect—the China or Cavendish Banana only is comparatively safe. Deep-rooting trees, such as the *Babul*, are the best shelter; bambus are unsuitable, because their roots run a long distance near the surface and greedily suck up all the nutriment available.

SOIL AND MANURE FOR THE BANANA.

The alluvium on a river bank, low enough to receive a dressing of silt from the high floods and high enough to drain freely, is the most suitable soil for the Banana, but the plant is by no means delicate in respect of soil, provided the essentials of luxuriant growth, abundant nitrates, phosphoric acid, potash, and lime be present. The roots being of considerable thickness, a loose, open soil will, other things being equal, permit rapid growth more freely than a dense one. It should contain the

residue from liberal manuring to a previous crop, and, especially if the soil be dense, the application of large quantities of bulky manure in a slightly decomposed condition while the soil is in preparation, a considerable time before planting, is of the highest benefit. As much as 50 tons per acre of town sweepings and slightly less of horse- or cow-dung, may be applied with profit. Poudrette, oilcake broken small, and dried fish may be used in the ratio stated under manure, and 10 cwt. per acre of nitrate of soda (Chili saltpetre) or of common saltpetre applied in doses of 1 cwt. per acre at intervals of ten days, will be of distinct advantage. The Banana occupying the soil such a short time and producing such a weight of fruit if encouraged, the material with which to carry on the duty of the soil must be provided in proportionate quantity and solubility.

PLANTING THE BANANA.

The best season for planting is the hot weather—the soil being warm, rooting takes place quickly, and the plant is prepared to utilise the rainy season by making rapid growth; but in order not to have the crop ripening all at one time, the planting may be extended from the beginning of March till May. During the monsoon, planting may be effected, but some of the plants are lost, and all are weakened by defective rooting.

The offset having been separated from the parent by a strong side-stroke of a hoe, cutting through the creeping ground stem of the parent, and all broken roots cut off carefully, the stump is dipped in a liquid plaster of equal parts soil and cow-dung with sufficient water, carried to the prepared field and planted 8 feet apart, the base of the new shoot being 12 to 15 inches under the surface, the vigorous new roots will appear at the base of the new stem above the union with the parent plant, therefore this portion should be in the soil. The Banana is a surface-feeding plant generally, its great flesh roots being produced in abundance and not of great length.

Tripods of three bambus should be arranged to support the fruit as soon as the bunch has formed, and as soon as the fertilisation of the flowers cease it is said to be advantageous to remove the pendulous ball of bracts and flowers. Some sap is lost in cutting away the ball, and it is doubtful whether the advantage does not go chiefly to the workman who gets an agreeable vegetable.

THE CROP.

If planted in April and property treated, the flower appears in January and the fruit ripens in May. A two-year-old plantation will ripen fruit within twelve months from the young shoot appearing at the side of its parent, and the plantations should not be retained more than two, or, in exceptionally favourable conditions, three years; after that time weakness becomes distinctly apparent. A plantation properly made should, with good fortune in the matter of storms, produce 10 tons of Bananas per acre, and small plantations have produced a very much larger ratio. When the fruit has ripened, the upright stem dries up: it contains much tannic acid, and decays slowly if closed from air. To produce rapid decay, it should be cut into convenient lengths and placed in a heap exposed to air; if moistened occasionally, the decay is more rapid.

TO GOVERN THE DIRECTION IN WHICH THE BANANA FRUIT MAY BE PRODUCED.

On looking on a Banana plant about two years of age, several shoots may be observed surrounding the base of the original plant, and the offsets, if in flower or fruit, may be observed to bear fruit on the side furthest from their parent, or the position once occupied by their original plant. This habit is retained, although the offset may be removed while young and the wound at its base which indicates the direction of the parent plant being placed in one direction, the fruit may be expected on the opposite.

THE BANANA OR PLANTAIN (*Mouz*, *Kela*).

The usually accepted distinction between the Banana or Plantain is, that the former is a "table" fruit, eaten uncooked, while the latter must previously undergo kitchen treatment; like other lines of demarcation in natural history, this one is by no means distinct, and varies with the degree of cultivation and the state of ripeness of each individual variety. All the sorts need cooking if used unripe, and some do not attain sufficient maturity for food till decay has far advanced; therefore, the name Banana is intended to include all edible fruits of the genus *Musa*. There is a considerable number of distinct sorts cultivated throughout tropical regions, but as each language gives a series of names, the number of names extant is vastly greater than the number of distinct sorts, and the labour necessary to collate the names and describe the sorts on a fixed system is very great, but a desirable work on the part of horticultural societies and public gardens. The author collected sorts from all available sources, cultivated the plants under like conditions, and endeavoured to ascertain their exact character, and the result of much labour is given in the following short notes. Although colour is noted in the following descriptions, it is variable in the same sort to a remarkable degree, and appears to be influenced by the soil.

SORTS OF BANANA.

1. *The Red Banana*—synonymous, *Rai-kele*, *Raj-kele*, *Ram-kela*, *Chandra-bale*, "*King of Prawns*," *Guindy Banana*—Stem very strong, reddish, medium height; leaves with red midrib and margins; fruit very large, cylindrical, red-skinned, with deep yellow pulp of superior flavour.

2. *The Golden Banana*—*Sone kale*, *Champa*, *Raj-rasa-bále*, *Guindy Plantain*—Stem very tall, weak; leaves of thin texture, large; petiole, 2 feet; fruit small, cylindrical, yellow- and thin-skinned, of very fine

flavour. The bunch attains 60 lbs. weight when carefully grown.

3. *The Purple Stem Banana—Tamdi, Kali*—Stem medium; leaves short, narrow, with red midrib; fruit large, average $5\frac{1}{2}$ oz., yellow, thick-skinned; flavour rich when cooked or fully ripe.

4. *Rajali Banana*—Fruit usually dried, three-angled; neck, $1\frac{1}{2}$ inch; body, 8 inch; point, $1\frac{1}{4}$ inch; richly flavoured when fully ripe or cooked.

5. *Goosavi Banana*—Stem medium height; fruit medium size, yellow, thin-skinned; flavour superior.

6. *Banana—Botati, Montham*—Stem tall, stout; fruit three-cornered, stout, thick-skinned, yellow; pulp sweet but cottony, and with little flavour.

7. *Chinese Banana—Gugi, Basri, Bengali*—Stem 6 feet, green, very stout; fruit cylindrical, 5 by $1\frac{1}{4}$ inches, yellow or pea-green when ripe; of inferior flavour except when fully ripe, then it is rich.

8. *Monthan* (Madras)—Bunch very loose; stalk, $1\frac{1}{4}$ inches; fruit, 6 by $2\frac{1}{4}$ inches, angular, smooth, yellow; pulp, white; skin, thick.

9. *Buffalo Banana—Mhaisi*—Stem, 10 feet, faintly reddish; leaves, $6\frac{1}{2}$ inches by $\frac{1}{2}$ inch, pale green, with faint red shade on midrib; fruit, 5 by 2 inches, 5 to 6 oz. in weight; stalk, 1 inch; skin, thick; pulp, pure white; sweet and mealy when fully ripe. A good cooking sort, very prolific, but not highly esteemed.

10. *Hardy Banana—Lokundi*—Stem, 10 feet, reddish, stout; leaves of thick texture, 10 by 2 feet, pale green, with whitish midrib; fruit, 5 to 1 lb. weight, 5 inches, including $\frac{1}{2}$ inch in neck, cylindrical, large; pulp, pure white.

11. *Karanjeli Banana*—Stem about 10 feet, of pale red tinge; leaves pea-green, medium size; fruit, 6 to 1 lb., fine pale golden, 4 by $1\frac{1}{2}$ inches, cylindrical, on 1 inch stalk and with $\frac{1}{4}$ inch beak.

12. *Cardamon Banana*—*Eliechi*—A very rare banana, the size of a man's finger, and with Cardamon flavour.
13. *Kunerpat Banana* (of Junir).
14. *Bankeli*—*Kulbali*—Used for leaves only.
15. *Narghingi*.
16. *Mutheli*.

TINNEVALLEY PLANTINUS.

1. *Mondan* = *Monthan*?—Very large; used for curry.
2. *Peyan*—Medium; used for curry.
3. *Pewan*—Very small; used for curry.
4. *Pachia nadan*—Long; green when ripe.
5. *Budi*, or ash-coloured—Used in curry.
6. *Kulbále*—Used for leaves only, seeds large.
7. *Shinga-bále*—Green when ripe.
8. *Chundra-bále*—Red fruit.
9. *Bhanga-bále*—Plant hardy; used in curry.
10. *Katbale* or *Kupra-bále*—Long, thick-skinned.

VARIETIES OF BANANA GROWN IN MYSORE.

From the *Gazeteer of Mysore and Coorg*, by Lewis Rice.

Rasa-bále, and *Raja-rasa-bále*, with a yellow custard-like pulp; *Putta-bále*, or *Ptta Gugunda-bále*, a small, sweet Plantain, the *Guindy Plantain*; *Madharanga Gujja China*, and *Gular-bále*—are all Butter Plantains. *Chundra-bále*, red Plantain; *Sakalati-bále*, red and cottony; *Pacha-bále*, green when ripe; *Haon-bále*, long and slender; *Yelatri-bále*, *arisma-bále*, and *áne-bále*, a very large kind; *Kalyani-bále*, very large and coarse; and *Búdi-bále*, greyish, used only for cooking.

CHITTUR BANANA.

1. *Padapatty*.
2. *Monthan*.
3. *Puvan*.

S. CANARA BANANA.

1. *Chundra-bále*.
2. *Rastali*.
3. *Devi-bále*.
4. *Mysore Kalhali*, much valued.

GRAFTING THE BANANA.

An impression prevails among the people of India that the Banana plant may be made to bear two or more kinds of fruit upon the same bunch. This result, they affirm, is brought to pass as follows:--A young sucker is dug up from each of two kinds of Plantain. The suckers must be as nearly as possible of the same size; these are split up cleanly in halves with a sharp knife, a half of one of the kinds is closely applied and bound to a half of the other kind, and planted in the ground in the ordinary way. These halves will soon unite and form one plant, which eventually will throw up a stem bearing two kinds of fruit. People who have some knowledge of the structure of plants are inclined to consider the idea to be mythical, but it is still doubtful whether it may not have a basis in natural science. The writer, after long considering the question to be unworthy of attention, tried to produce the union described, with the following result. The underground portion of the stems, consisting chiefly of cellular tissue, united so firmly that, on force being applied, the union was not severed, but the adjoining tissue gave way, the distinctly fibro-vascular parts did not cohere; but what would have been the result if the united portions had been permitted to live is still doubtful. There is no apparent reason why a bud combining all the tissues of the two varieties should not have developed, but unfortunately this did not occur to the writer while opportunity offered of testing the question, and the experience is recorded in the hope that others will complete a very interesting inquiry.

BANANA DISEASE.

The Banana, fortunately, is little injured by insect or fungus disease; but a little whitish toadstool (*Marasmius simiustus*, *B. and C.*) sometimes appears in great numbers on the stem, evidence of decay. To cut down and burn the stems is the only cure known.

THE CARDAMOM—*Elettaria cardamomum*,¹ *Elich*i, *Veldoda*, *Ella-kai*, *Elettari*.—The cultivation of the Cardamom in other than the hilly districts of Southern India and Ceylon has often been tried, with very little success. The conditions under which the plant thrives are—an altitude of 2,000 to 4,000 feet, a heavy rainfall extending from May to January, and the remainder of the year dry. To get the seed to germinate, it should be gathered from the plants without the usual preparation for the market, by soaking the lime in water, then mixed with damp leaf-mould and kept in a moist place. In my own experiments the seed germinated freely nine months after sowing. Captain Dickson, who was in charge of the Wynaad district, wrote:—"The cultivators cut down a large tree before the rainy season, and find that about a month later numerous Cardamom plants have sprung up from the soil the tree stood upon. These are planted in suitable places, and four years later the flowers stalk shoots from the ground at the base of the leaf stalk during February, and the fruit is ripe in November. It continues to bear for three years, and the cultivators believe that seed will never produce Cardamom plants." In Mysore, Cardamoms are grown in Areca-nut plantations, and are transplanted soon after gathering the fruit. The plantations bear the second year after planting. The yield, of course, varies greatly, but the quantities observed by officers deputed for the purpose on one occasion may be of interest: Supari, 1,160 lbs.; Cardamom, 114 lbs.; Pepper, 303 lbs., per acre, were gathered. The picking of Cardamoms began 17th September, and was continued till 3rd March. Pepper and Supari gathering begins 17th December. The cost of cultivation of a mixed plantation of Betel-nut, Cardamom, and Pepper was Rs. 298 10 0 per acre, and the value of the produce was Rs. 585 0 0.

¹ *Elettari*, *elettari*, its vernacular name in Malabar. *Cardamomum*, cardamom.

COSTUS SPECIOSUS—*Keoo, Keemoka*.—An elegant plant when growing on the bank of a stream or tank, and producing stems 3 to 4 feet in height, bearing oval leaves arranged spirally on the stem and at its apex a spike about 4 inches in length of large, pure white flowers. 2,000 feet altitude and slight shade from an overhanging tree improves its elegance.

COSTUS ARGYROPHYLLUS has foliage with a silvery sheen, especially fine with lamp light; and **C. AMAZONICUS** is a dwarf shy flowering species.

CANNA.—Hybrids of this genus are elegant subjects for the banks of a pond or on islets a foot or so above the highest level of the water. The seed is very hard, but if mixed with cow-dung and water and placed in sunshine until swollen, and then planted in very richly manured soil, they germinate freely, and further propagation may be from division of the root-stock.

CURCUMA LONGA—*Turmeric, Hullud, Urisma*—should be cultivated on a small scale in every garden. In field culture, from December to May plantations are ploughed up and the roots prepared for market. At the same time, in land that has been extra carefully ploughed, manured, and laid out in ridges for irrigation, in the same manner as preparation is made for planting sugarcane, pieces of the fresh end of the rhizome, about an inch long, are planted 1 foot apart, between ridges which stand about 18 inches apart, shaded with leaves and freely irrigated. Subsequent culture consists of irrigating, weeding, keeping the soil open, and applying manure once in three months; where procurable, oilcake manure is preferred. Produce per acre, freshly dug, weighs about 12 tons, and when dried for market, about 2½ tons. In some parts of Bengal irrigation is unnecessary, and the sets are kept moist till the rain sets in.

CURCUMA CÆSIA—*Kali-halad, Manu-pasupu*.—An elegant herb, adapted for decorative purposes during the

rainy season. The leaves rise from an underground stem and attain, with the leaf-stalk, 3 feet in height, of a bright green, with a purplish-brown vertical cloud in the centre. The flowers appear in May, and are on a stout, erect spike, having large, bright red bracts (*Coma*) within which the yellow flowers nestle.

CURCUMA AMADA, the Amada or Mango-Ginger; and C. ZEDOARIA—*Kachora*, *Kachoram*, *Bun-huldi*, *Pulakizhanna*—a highly ornamental species; are of easy culture in moist climates, and may be treated like *Turmeric*.

GINGER—the underground stem of *Zinzibar officinale*, termed in the green state *Adruck* or *Alla* and in the dry condition *Sunt* or *Sunti*. As a market garden product, for sale in the green state, Ginger is cultivated in the neighbourhood of most large towns within our limits. The requisites are—a rich, friable, moist soil, and pieces of the “root” planted about 6 inches apart in lines about 2½ feet apart at the beginning of the rainy season, and the soil kept clean and moist; sometimes ridges are formed on the lines and water-courses between. In field culture, the ground is ploughed very thoroughly, heavily manured, and laid out in ridge and furrow with the plough, as in sugar-cane cultivation; and, on lifting the crop, little green pieces of the “root” are cut off and either planted directly on the sides of the ridges or taken to the nursery and planted close together, to be transplanted as soon as sufficient rain has fallen. The former system, direct planting, is employed where irrigation is always necessary, the latter where the rainfall is usually sufficient. The yield varies from 2,000 to 3,000 lbs. per acre of dry Ginger.

In tropical America, the “root” is dug up, dipped in boiling water a short time, and dried; this makes Coated or Black Ginger, if scraped; it is uncoated or white, and is sometimes bleached with sol. chloride of lime or sulphur fumes; and 4,000 lbs. per acre are obtained from land newly reclaimed from forest.

HELICONIA,¹ a genus of easy culture in a rich border kept moist and slightly shaded. The species are propagated by division.

HELICONIA AUREA STRIATA, resembles a dwarf *Musa*, with a slender stem 3 feet in height; the leaf-stalks are striated with green and yellow, and become recurved at the top.

HELICONIA BICOLOR has gracefully arching lanceolate leaves, 15 by 4 inches, on stalks rising from the ground, and bearing white flowers enclosed by scarlet bracts.

HELICONIA BAHIA has ovate-lanceolate leaves, 18 by 8 inches and showy bright orange bracts enclosing the flowers. A showy plant in a shady place; in full exposure the leaves become withered.

HELICONIA METALLICA has broadly lanceolate leaves with the central rib margined and curving veins of a bronzy-red; the lower side of the leaf is entirely of the same tint.

HELICONIA VINOSA has broadly lanceolate stalked leaves 18 inches in length, bright green above and purplish beneath; the upper surface transversely ridged, and the stalks as long as the blades of the leaves.

HEDYCIUM.--This genus of Himalayan herbs has a creeping root-stock, producing annual erect branches 3 to 4 feet in height, bearing at the top a large cluster of fragrant flowers, variously coloured. These plants are specially adapted for the margin of a pond or a stream with the water within a few inches of the roots during the rainy season and gradually receding, so that the root-stock may become dry. In planting, the upper side of the root-stock should remain above the surface; very rich soil is necessary. Many cross-bred plants of this genus are offered.

¹ *Heliconia*, from Helicon, a mountain in Greece, consecrated to the muses.

worthless, and it is only in specially favourable positions, with a heavy rainfall, distributed over nine months of the year, that its cultivation may be profitable. It is useful in the garden if much grafting is done, because the fibre in the leaf stalk is stronger than that of the common banana; but it should not be planted where the banana is grown for fruit, because its pollen will fertilize the ovules of the other species, and the result will be abundant hard black seeds as large as a pea in the fruit that, without seed, is delicious food.

MUSA SUMATRANA, from Sumatra, is a dwarf species with rich purple variegation on the leaves. Very showy when grown on a bank of rich soil in the conservatory.

MUSA SUPERBA—*Chounie*, *Kowdari* (often called the *Wild Plantain*)—is common on the Western Ghats, where, during the rainy season, it adorns the hill sides with magnificent foliage. It may be raised from seeds, but bulbs taken during March and April bear carriage a long distance without injury. A very rich soil and abundant water while growing are necessary; and it should not be planted in a banana fruit garden, as the banana ovules may be fertilized and seed produced where it is not wanted.

RAVENALA¹ MADAGASCARIENSIS—the *Traveller's Tree of Madagascar*—is a tall plant having leaves like the banana, but arranged in two rows, forming a large fan-like head, borne, after many years' growth, on a stout palm-like stem. The flowers are large and showy, and are succeeded by seeds with an elegant blue membranous covering. On the banks of a tank in a very rich soil this plant develops grandly, and a supply of water may be obtained by piercing the leaf-sheath. Cultivation extends from the sea-coast to 5,000 feet altitude under the equator, but gradually diminishing as it extends.

¹ *Ravenala*, said to be the native name of the plant in Madagascar.

STRELITZIA REGINÆ,¹ a showy herbaceous plant from South Africa, having ovate, entire leaves, 15 by 6 inches, on radical petioles 4 feet in length, and large orange and purple flowers of irregular form. It grows slowly with moist border treatment at Poona, and may be increased by division.

IRIDACEÆ, *The Iris Family.*

In our gardens this family is represented by—

THE GLADIOLUS.—An herb with sword-like vertically flattened leaves and spikes of flowers arranged on one side of the stem, of every shade of colour, and of particular use in house decoration because, when half opened, the spike may be cut and taken indoors, where, by giving fresh water daily, it will continue to open flowers up to the end of the spike. Any rich, friable, well-drained soil is suitable. In districts having slight rainfall, the bulbs may be planted at the beginning of the rainy season 4 inches deep; while growing fast, water freely with liquid manure. After flowering, when the leaves become yellow, gradually reduce the supply of water, and, when fully dried up, dig up and store in a cool dry place till next planting season. The *Gladiolus* thrives well at Poona, Bangalore, and other places having a similar climate, but where the rainfall is heavy it is difficult to manage, unless bulbs are brought every season from some of the dry districts or from Europe. In such cases the bulbs may be planted during November and December; if far north, protection at night will be necessary to reduce radiation. Should a supply of bulbs be received in December, excited to grow from the damp in the packing case, it is advisable to plant at once deeply in a sheltered place with rich sandy soil. As soon as the flowers appear the spikes should be cut, and, if the foliage

¹ *Strelitzia*, in honour of the wife of Charles III., Charlotte of Mecklenburg Strelitz. *Regina*, the queen.

is kept healthy, one or two new bulbs will form above the old one and be in good condition for planting the following season.

IRIS FLORENTINA.—This Iris thrives at Poona with moist border treatment, and produces its large white flowers during the rainy season. It thrives on the margin of a pond where its roots reach water easily.

IRIS JAPONICA has the standard lilac and the “falls” spotted with yellow and white, fimbriated at the margin, and having a crest two-thirds of the way up.

BELEMCANDA CHINENSIS—*Balamkanda*—is an herbaceous plant with regular, yellow flowers and ensiform leaves, as in Iris. It grows wild in Himalayan Duns, and is cultivated with little trouble.

TIGRIDIA PAVONIA.—A showy herb having lanceolate or sword-shaped folded acute leaves, 10 to 18 inches in length, clasping at the base, and bearing large orange-coloured lily-like flowers. In districts with slight rainfall ordinary border treatment suits it well.

CROCUS SATIVUS.—Bulbs brought from Kasmir, bloom freely in a conservatory, but the plant does not become established.

BABIANA.—Garden varieties, are Cape bulbous plants with plicato leaves and showy flowers; roots imported bloom nicely in a cool shady place in spring, but do not grow in a hot climate.

IXIA HYBRIDS are bulbous plants, originally from the Cape, which blossom during winter and spring with a variety of rich tones of yellow and red; bulbs imported during autumn bloom nicely in a moist conservatory from 1,500 feet altitude upward, but *Ixia* requires 4,000 to 7,000 feet altitude to thrive.

WATSONIA ROSEA, from South Africa, is a free-flowering lily about 2 feet high; suitable for a cool dry climate about 2,000 to 5,000 feet altitude.

BROMELIACEÆ, *The Pine-apple Family.*

“Pine-apple juice contains a proteid-digesting ferment. The unripe fruit, in large doses, is, with other acid fruits, reputed abortive.”—*Pharma. Ind.*, III., 509.

A group of South American plants resembling the Pine-apple (*ananas*) in the arrangement and texture of their leaves. Many of these plants are epiphytal, and beautiful effects may be produced by fixing the plants on the stems of trees in imitation of the natural condition by tying some leaf-mould in sacking with moss on the outside. If *Pitcairnea pulverulenta* be planted in this manner, and watered with the syringe daily during the rainy season, it will display its fine blossom to advantage, and will need watering only about once weekly during the dry season.

THE PINE-APPLE—*Ananas*, *Anàras*, *Kaita-chakka*, *Parangi-chakka*, *Ananassa sativa*.—A hot moist climate, with slight fluctuations of temperature, with shelter from dry wind and nocturnal radiation, and a friable, brown, loamy soil, thoroughly tilled, heavily manured, and watered sufficiently to keep the ground moist, are the essentials in growing the Pine-apple. In the countries where those conditions occur naturally, Pine-apple cultivation is often neglected, or carried on in such a slovenly fashion that the produce is of little value, and is often left for hogs to eat. Where the fruit is more difficult to procure, and its cultivation is conducted with care, high prices are obtained for the fruit, and it is valued as one of the most agreeable digestives, useful against dyspepsia, and a superb ornament of the dinner table.

To produce this fruit in the hot dry districts, procure a quantity of offsets or shoots from the base of good Pine-apple fruits (those bear carriage fifteen days without soil) and plant closely in a sandy soil, well shaded, and kept moist by gentle watering; a garden frame which can be kept close and moist is desirable. Meanwhile, a large plot of loamy soil should be heavily manured and

tilled thoroughly by repeated ploughing or digging, and *Shewari*¹ seed sown thickly in lines 4 feet apart: with regular thinning and irrigation, the *Shewari* trees will soon be high enough for shelter, and the rooted offsets may be carefully set out 3 feet apart in a furrow, intermediate between the *Shewari* lines. When growth has begun, apply more manure along both sides of the row of plants and hoe the ground at intervals, drawing the fine soil towards the Pine-apple plants. The intention of planting *Shewari* is to keep the place warm on cold nights and cool under strong sunshine; therefore, the larger the plantation the greater probability of success. The trees must be frequently pruned, and especially after the fruit has attained full size; it is advisable to let the sun in freely to ripen the fruit completely; the prunings of *Shewari* are excellent food for goats, and the goat-dung is wanted as manure for the Pine-apple. The sort commonly cultivated in India attains 3½ lbs. in weight, is golden-brown in colour, cylindrical, or slightly barrel-shaped, with uneven pips and hollow at the apex. In moist districts without hot winds or cold nights the lines of *Shewari* are unnecessary. Pine-apples may also be grown in pots, as is the custom in temperate climates. A rich soil, which will bear watering without becoming dense and hard, is necessary. Frequent applications of clear liquid manure, and as frequent stirring the surface to prevent the soil from caking, and withholding water somewhat after the fruit is full grown and ripening, is essential. Strong suckers flower within six months of planting; June is the most favourable month, but with irrigation any of the warm months is suitable, and ripen fruit between five and six months later. By careful cultivation, the plantation may last three years.

Improvement of the Pine-apple may be effected by cross-breeding the varieties and selecting the best of the varieties produced, as indicated under "Hybridisation." This has recently been effected in Jamaica: Pine-apple

¹*Sesbania egyptiaca*, *Jewanti*, *Shewanti*, *Shewari*.

flowers cross-fertilized in April and May gave ripe fruit in July, and the seed sown in August and carefully tended give the first fruit twenty-seven months later.

Of the sorts of Pine-apple cultivated, the SMOOTH CAYENNE, or *Kew Pine*, is a robust grower with smooth-edged leaves; the fruit occasionally grows to a large size, and is of delicious flavour and juicy.

"MAURITIUS" PINE has prickly-edged leaves and moderately large yellow fruit of good flavour.

GAL-ANNASI differs little from the latter. Suckers are procurable at the Botanical Gardens, Paradeniya, Ceylon, at a nominal price.

Jackals are fond of ripe Pine-apples, therefore the plantation may be fenced with wire netting or the fruit carefully watched and cut before the ripe odour is developed.

The Pine-apple is subject to a mite just visible to a sharp eye, which causes irregular ripening of the fruit. To the fire with all affected plants, and, in making a fresh plantation, let it be at some distance from the old, and disinfect the suckers for planting by washing them in running water and placing over burning sulphur for ten minutes. It is well to provide two cases, one with holes in the bottom to place the suckers in, and the other, of the same size, to hold the burning sulphur.

HÆMODORACEÆ, *Bloodroots*.

A small family of Lilies, allied to *Bromeliaceae* and *Iridaceae*, distinguished by their reddish roots.

SANSEVIERIA GUINENSIS, flat-leaved.

SANSEVIERIA ZEYLONICA, terete-leaved.

SANSEVIERIA ROXBURGHII, terete, deeply channelled.

SANSEVIERIA GRANDIS (*Bot. Mag.*, Feb., 1903).

SANSEVIERIA CYLINDRICA.

SANSEVIERIA ROXBURGHIANA, occurs in moist sandy regions, and grows well in the garden with the least possible attention.

OPHIPOGON JAPONICUS.—A plant with dark green grass-like leaves, 9 to 12 inches long, $\frac{3}{16}$ inch wide, that thrives in shady places under trees when regularly watered. It thrives especially in northern gardens, or at 3,000 to 7,000 feet altitude.

OPHIPOGON VARIEGATUS has leaves 15 inches by $\frac{1}{2}$ inch, dark green, with yellowish-white stripes, and, in September, erect racemes of small purple flowers; 3,000 to 7,000 feet altitude suits it. This looks like a variegated *O. intermedius*.

AMARYLLIDACEÆ, *The Amaryllis or Crinum Family.*

Our gardens are rich in beautiful flowering plants, mostly with bulbous "roots," belonging to this family.

As usual with bulbous-rooted plants, seasons of rapid growth alternate with periods of rest more or less complete. During the growing season thorough watering is necessary, during the resting season very little is required, but protection from the sun is desirable, and the bulbs bear transplanting with impunity.

AMARYLLIS HIPPEASTRUM¹—*Hippeastrum hybrids*.—Some of the new varieties of *Amaryllis* are great acquisitions in gardens, as the flowers are large, of great substance, and in many shades of colour, from pure white to crimson, blended in great variety of streaks and bands, affording contrasts of especial value, because the plants may be in bloom during the first few weeks of the monsoon, when flowers are very scarce.

These Lilies grow freely in any ordinary garden soil, and naturally flower during the hot season; but after

¹ *Amaryllis*, a countrywoman mentioned by Theocritus and Virgil. *Hippeastrum*, from *hippeas*, bright, and *astrum*, a star.

keeping the bulbs dry during December and January, they may be taken up at the beginning of February, and kept on a cool dry shelf till the monsoon breaks, then the bulbs should be planted, and will flower about three weeks later. If left in the ground and watered occasionally, the bloom comes between the middle of February to the end of the hot season: at this season the flower stem may be cut near the base soon after the first flowers are open, and kept in water indoors. By giving fresh water and cutting a small piece off the bottom of the stem daily, the flowers will continue opening and retain their beauty and fragrance a considerable time: some have been kept fresh during fifteen days of an Indian April. Propagation by off-sets and by seed. Slight shade prolongs the duration of the flowers.

THE WATER CULTURE OF "AMARYLLIS."

These Lilies may be grown in water in this country in the same manner as Hyacinths and other bulbous plants are grown elsewhere. For this purpose, let the bulbs be dug up early in December and kept dry; in February take an ornamental bowl, fill to within an inch of the rim with sand, plant several bulbs close together, water enough to moisten the sand, and place in shade. In a few days the plants will be in flower, and may be kept indoors; one watering weekly will be sufficient. When out of bloom, re-plant in garden.

AMERICAN ALOE—*Kantula*, *Bilavati ananas*, *Maquey*, *Agave amertcana*.—Grows on rich loose soil with perfect drainage, yields salt water soap from its pulp, fibre from its leaves, and malodorous palm-wine from its sap.

AMERICAN ALOE, VARIEGATA, has yellow stripes at the sides of the leaf.

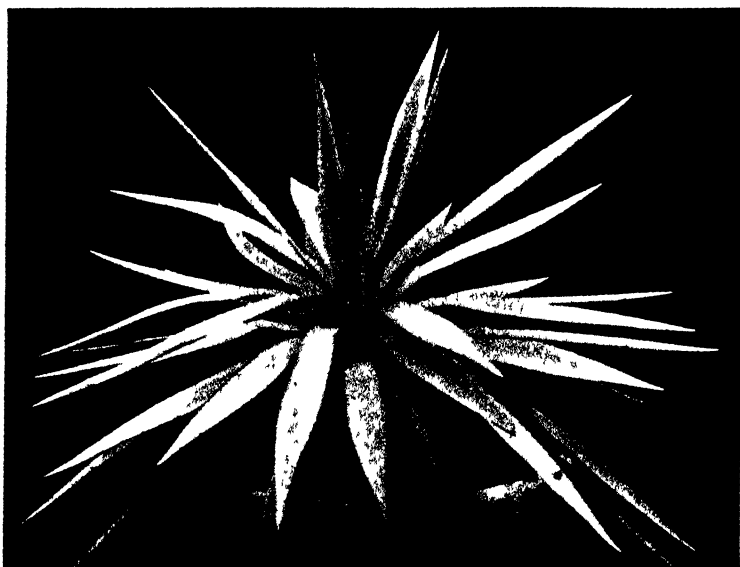
AMERICAN ALOE, PICTA, has yellow in the centre. Propagated by off-sets.

AGAVE VIVIPARA—*Guital*—has leaves 3½ to 4 feet in length, having a slender spindle-shaped brown spine

$\frac{3}{4}$ inch in length at the end, and numerous dark brown spines $\frac{1}{8}$ inch in length, some curved backwards, some forwards. Useful for fences and fibre.

AGAVE AMERICANA CANTULA—*Daghti-Guita*.—A variety of the above; is a fence plant giving short fibre.

AGAVE CANTULA VARIEGATA was observed in Poona Gardens in 1890, but its history has not been recorded.



AGAVE VIVIPARA COOKEI.

It was rapidly propagated, and in 1894 there appeared at the base of one of the old plants a shoot very much whiter than its parent. That shoot is now a strong plant of a clear white, with enough pale green in the centre to ensure growth; it is now described as

AGAVE VIVIPARA COOKEI, in compliment to Theodore Cooke, C.I.E., formerly Principal of the College of Science, Poona. Leaves 18 by 2 inches at broadest, lance-shaped, margins $\frac{1}{2}$ inch ivory white, centre pale green, terminal spike $\frac{1}{2}$ inch black, marginal spines at

first white, ultimately black, curved forward. This form has continued as at first, but the parent plant has produced many other variations, some of them of decided merit as ornamental plants.

AGAVE WOODROWII is a variation of the above, having much pure white in the leaf and the green part a pale grey.

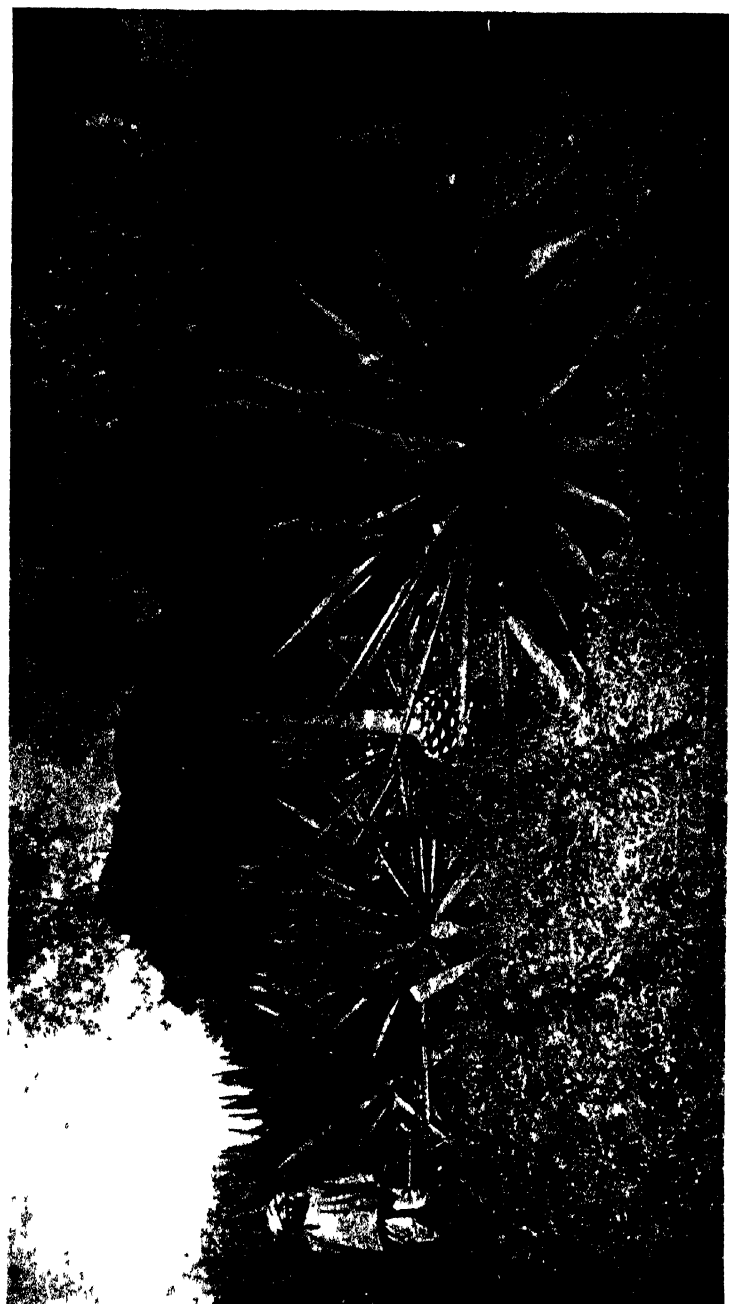
AGAVE SISILANA—the *Sisil Hemp*—has usually an absence of spines on the margin of its aloë-like leaves; was introduced in 1892, attained full development and flowered in 1898. It thrives under the most varied conditions, but especially in a moist atmosphere with a red, stony soil and perfect drainage, but is unable to withstand frost. The leaves give 3 per cent. of their weight, of a bright, strong fibre, used for binding-cord in the harvest field. Near the Western Ghats, where the soil is thin and the atmosphere moist, this promises to be a most remunerative crop, but it can only be profitable in large plantations with a factory to extract the fibre. A simple machine has been invented at Madras which promises to do the work required.

AGAVE RUPICOLA.

BOMAREA CARDERII (from Columbia), a showy climbing Lily, having a terminal great cyme of flowers; is fit for a dry climate at an altitude of 4,000 feet.

CHLOROPHYTON ELATUM VARIEGATUM.—An herbaceous plant, with linear white-striped leaves, which thrives in the conservatory with liberal watering during the rainy season and much restricted watering during the hot season. It is increased by off-sets.

CRINUM.—A genus of charming bulbous plants bearing Lilies, pure white or tinted with rose or purple, chiefly during June to January, and usually with an attractive odour, but, in July, subject to the ravages of a black caterpillar which eats the flower buds and the tissue of the leaf, leaving the transparent cuticle. A large basket



AGAVE SISILANA

placed over the plants before sunset and removed in the morning, protects the grand heads of flowers from the eggs of the parent fly, and a daily search for grubs is advisable. A very rich soil and abundant water during the rainy season is necessary. Propagated by off-sets.

CRINUM AUGUSTUM (from Mauritius and Seychelles).—A very showy species, having a pleasant perfume, and flowering in a moist border slightly shaded. The strong compressed flower-stalk bears 12 to 20 flowers, each expanding to a width of 10 inches, white, tinged with red inside, purplish-red outside. The flowers may be culled as they expand, or the whole may be taken indoors to open in water.

CRINUM SUPERBUM, *R.*, is very similar to, if not the same, as this species.

CRINUM BRACHYNEMA—*Mahalla*.—A showy bulbous plant, very beautiful when sprouting from bare rocky soil at Mahableshtar, altitude 4,500 feet, about the end of May. The pure white sweet-scented flowers appear usually before the leaves in heads of fifteen to twenty, on a radical naked stalk. The tubular part is greenish and equal in length to the expansion of the lobes, and the stamens have filaments much shorter than other species of this genus.

In the plains it is advisable to grow this plant in pots, with a saucer for water and shade during the monsoon, and to store in a cool corner after the leaves have dried up. If left in a border it sends up abundant leaves, but does not blossom.

CRINUM BRACTEATUM.—A dwarf, free-flowering species having elliptical, pointed leaves 1 foot in length by 4 inches broad, and producing during April to June a compressed lateral flower stalk as long as the leaves, bearing about thirteen white flowers, having linear segments 3 inches by $\frac{1}{4}$ inch, the outer segments being green at the points; a pretty lily for a shady nook. It enjoys sandy soil and free watering from April till October.



CRINUM BRACHYNEMA.



EUCHARIS LILIES.

Facing page 543.

CRINUM ENSIFOLIUM—*Samp-kanda*.—A pretty white lily, growing near water level on the banks of rivers in the Deccan, and a very desirable plant for the banks of tanks, because the flowers may be culled separately as they open and a supply obtained during several months for table decoration.

CRINUM GIGANTEUM (from South Africa)—*Sookh-durshan*.—An elegant white lily (described in *Roxb. Fl. Ind.*, II. 140). When grown in shade, the leaves are much contracted downward. It enjoys a moist shaded border.

CRINUM LATIFOLIUM—*Mahalla*.—A fine bulbous plant, having large flowers, pure white, tinged with red on either side of the centre of each segment. The leaves are variable in length—in the Mahableshtar variety about 2 feet in length—but unclasping each other at the base so as to make a false stem 1 foot in height and having the flower stalk exceeding the leaves by a few inches, forming a very graceful plant. It occurs gregariously at 2,000 to 4,000 feet altitude on Western Ghats.

CRINUM WOODROWII—*Ghan-ache-Mahalla*.—As figured in the *Bot. Mag.*, t. 7597, appears a very attractive plant, but its odour is unbearable; its habitat is 4,500 feet altitude, and it may be useful in hybridisation.

CRINUM RHODANTHUS (of Ngamiland), as its specific name implies, has rose-coloured flowers, and is of easy culture at warm elevations.

CURCULIGO RECURVATA.—A handsome herbaceous plant, having large radical, lanceolate, plaited, entire leaves that are very useful for decoration, and small yellow flowers. This plant grows nicely on a rich shaded and moist border. Propagated by division.

EUCHARIS¹ **AMAZONICA**, one of the most beautiful of the Amaryllis family; the flowers are pure white and delicately perfumed. It requires a rich soil and a moist

¹ *Eucharis*, a manufactured name, meaning very graceful.

atmosphere throughout the year and plenty of water during its growing season, June to February. In the hot season it should be permitted to dry to some extent, but never kept dust dry, as the plant is naturally ever-green, and if the roots be roughly disturbed it takes long to recover. On the shore at Marmagoa, one of the houses has a magnificent collection of *Eucharis* in fine condition although fully exposed.

EURYCLES SYLVESTRIS (of Malay and Australia).

FURCRÆA GIGANTEA.—A large "aloe," having typical *green* leaves 5 feet by 9 inches, without spines on the upper third of leaf. After three years in good soil it flowers and produces bulbils; it thrives in cool districts.

FURCRÆA WATSONIANA is variegated, with yellow stripes.

HÆMANTHUS GRANDIFLORA (from Columbia).—A small bulbous plant bearing large heads of crimson flowers on short upright stems. A rich well-drained soil and plenty of water while growing, but very little during the hot season, is the treatment it requires.

HIPPEASTRUM BICOLOR (from Chili) is a species which was for many years almost the only sort in Indian gardens, and is still abundant in some in the open garden. The flower is an attractive flame colour, with a greenish star in the centre; but when treated with water culture and placed in the dim light of a drawing-room in the tropics during the hot season, there are few more charming flowers: the size of the blossom is increased and the tint softened, so that it may scarcely be recognised as the little-valued garden flower.

HIPPEASTRUM RETICULATUM.—A bulbous plant producing two or three radical dark green leaves, having an ivory-white midrib and spreading on the surface. At Calcutta and Bombay, its pink and white flowers, 3 inches in diameter, about 1 foot high, may be seen in conservatories during the cold season. To induce this plant to

bloom, water may be withheld a few weeks, then resumed; the result is usually fresh growth and blossom.

HYMENOCALLIS LITTORALIS—"the Lilies of the Caribbean shore," "*Spider Lily*."—An evergreen bulbous plant bearing white flowers during June to August. The leaves are linear, rising from the ground during the rainy season 2½ feet by 1½ inches and gracefully curving outward. The flowers are of six linear segments, 4 inches by ¼ inch, recurved, and the stamens united by a membrane. The plant is a very beautiful object during the rainy season in the Deccan, whether in a small circular bed or in long lines near the margin of a path; the plant is of interest to microscopists, because plastid movement may be seen in it easily with a high power.

HYMENOCALLIS MACROSTEPHANA.

HYMENOCALLIS CARIBBÆA.—The leaves are in two ranks and 18 by 3 inches, the flower-stalk equal to the leaves in length, two-edged, and bearing during the cold season six to eight pure white flowers resembling those of the "*Spider Lily*"; leaves 1½ to 2 feet, linear, lanceolate, 2½ inches wide at middle; scape two-edged, 18 inches long; head sixteen- to eighteen-flowered; tube green, 2 to 3 inches; lobes white, 4 inches by ¼ inch, contracted at apex; filaments green, joined by a toothed white membrane; anthers versatile, pollen dark orange.

LILY OF THE VALLEY—*Convallaria majalis*.—It is now practicable to get roots from temperate climates by post; pot them in good loam and place in a moist conservatory. The flowers appear from Christmas onward.

LYCORIS AUREA.—A pretty golden, erect, funnel-shaped lily, with waved receding segment, and linear leaves 1 foot in height. It blossoms at Calcutta during the cold season if grown on a moist border shaded during high sun. Propagated by separating the bulbs.

NERINE.—South African lilies, blooming in autumn and having rich colours, from rosy to violet. They are

adapted for 3,000 to 7,000 feet altitude with protection from high sun and heavy rain, and, while at rest during the hot season, should be kept dry.

NERINE SARNIENSIS—*Guernsey Lily*—is violet-red.

NERINE FOTHERGILLI is scarlet.

SPREKELIA FORMOSISSIMI—the *Jacobeia Lily*.—A brilliant crimson or white showy flower with six strap-shaped petals; thrives when treated as *Amaryllis*.

ZEPHYRANTHES TUBISPATHA (from West Indies and Columbia) and Z. ROSEA (of Cuba) are beautiful *Amarylls*, with grass-like leaves and rose or white crocus-like flowers. Very useful for the ground-work of a large bed with choice shrubs planted widely apart. These plants burst suddenly into bloom about three times yearly, after a fall of rain, and flowers are produced freely enough to cover the ground entirely.

TACCACEÆ, *The Pigroot Family.*

A very small group of interesting herbs with tuberous roots, valued as a source of starch. They thrive with the same treatment as *Caladium*, and are very elegant while in flower; during the dry season they should be laid aside in shade.

TACCA PINNATIFIDA—*Devakanda*, *Towkir-achajhad*.—Grows on hills in Concan, whence the roots may be obtained, potted in rich soil, and while growing may be watered freely. Its radical three-parted leaves, each division twice or thrice divided, and the whole 2 to 3 feet in length and breadth, and its umbel of drooping greenish flowers intermixed with long slender filamentous bracts, are very handsome.

TACCA ASPERA has oblong, entire leaves, flowers like the above, and a rough scape; and T. LAEVIS has similar leaves with a smooth scape.

DIOSCOREÆ,¹ *The Yam Family.*

A group of climbing plants yielding esculent roots known as *yam*, *alu*, and adapted for cultivation in districts having a heavy rainfall. Any ordinary garden soil is suitable, and propagation is effected by planting the oldest part of the tuber; in many of the varieties this is also the narrowest part, and it may be recognised by the buds. The foliage is of a very luxuriant character, well adapted for covering unsightly objects during the rainy season, but drying up completely soon after. Several varieties with coloured foliage are in cultivation.

DIOSCOREA ALATA—*Chupuri-Alu*, *Goradu*—has round tubers internally white and a six-sided twining stem bearing four-angled, five- to seven-nerved, long-stalked leaves, expanding at the base (*sagittate*). The female flowers are few but fragrant, and in erect spikes; the male in abundant tassels.

DIOSCOREA PURPUREA—*Lal-Alu*.—Tubers oblong, outside purplish, inside tinged with red, stems six or more winged perennial near the base.

LILIACEÆ, *The Lily Family.*

Includes many garden plants that are much valued for foliage (*Dracaena*), for bloom (*Yucca* and *Glorioso*), and as esculents (Onion). For all the purposes mentioned, luxuriant growth is desirable, therefore a soil rich in vegetable matter should be employed, with much shelter, and slight shade for the species valued for ornamental foliage. Propagation is easily effected by cuttings of the stem and by seeds, or by division of the underground stem.

A manure specially compounded for crops of Onion, Shallot, Leek, Garlic, and Chives has—nitrogen, 5.65 %;

¹ *Dioscoreæ*, from the genus *dioscorea*, after Dioscorides.

phosphoric acid, 10·35 %; potash, 20·10 %—and is applied at the rate of 8 to 10 oz. per square yard.

AGAPANTHUS UMBELLATUS (of South Africa), a bulbous plant having linear pointed leaves, rising from a bulb which is completely buried, and large umbels of flowers, from pure white to deep blue, on a naked stalk (scape) rising from the bulb. This plant grows well at 4,000 to 7,000 feet altitude, but when brought to the plains flowers freely for a time and then dies. In temperate districts it thrives with ordinary border treatment. Propagated by division and seed.

ALOE PERRY (from Socotra).—The Socotrine Aloes is very similar to the Barbado Aloes, but has a purplish hue on the stem and lower parts of the leaf and the orange flowered outside and green at point of buds.

ALOE VERA—*Yelia*, *Korfad*, *Kalabanda*, *Lola-sara*.—The source of the drug aloes, its inspissated sap.

ALOE FRUTICOSA—*Ghikumar*—with a woody stem and narrow recurved toothed leaves; and **A. ZEBRINA**, with short, stout, dark leaves having transverse pale bands; are to be found abundantly in gardens in dry districts.

ASPARAGUS¹—*Asparagus officinalis*, *Hilun*, *Kak-doun*.—This vegetable thrives with much heat during the growing season, but, to get large stalks, must have a distinct season of rest: therefore, it is only in northern countries or high altitudes that its cultivation is profitable. It grows well in a salt soil, but that a special quantity of salt is necessary for its cultivation, is doubtful, every soil that is highly manured with town products being well known to contain much salt. Abundant moisture in the soil is also necessary, but to have the pores of the soil filled with stagnant water is incompatible with the bacterial and oxidising action which brings

¹ *Asparagus*: *A*, intensive, and *parasso*, to tear, in allusion to the prickles of some species.

plant food into a condition fit to be assimilated by crops at a rate sufficiently fast to produce satisfactory growth. The shoots of *Asparagus* produced in a hot climate are not nearly as large as those produced in France, but the crop comes in a shorter time. A deep, sandy, well-drained soil, turned over 2 feet deep and heavily dressed with decayed stable litter and fish and kept moist by regular watering, is desirable. *Asparagus*



ASPARAGUS PLUMOSUS.

seed may be sown on a small bed and transplanted when several shoots about 6 inches high are formed, but as the long fleshy roots are easily injured, it is generally preferable to sow where the plant is to remain. The seed may be sown in lines 15 inches apart, and the young plants thinned out gradually to one foot apart in the line. The sowing season must be regulated so that the young plants may not be subjected to great heat and moisture at the same time. November to January is generally suitable, but if the rainfall is light, August is a favourable season. As *Asparagus* plantations in this climate do not last long, it is advisable to prepare a fresh one yearly, and in the third year of growth the shoots

are as large as ever they will be. The common *Asparagus* as an ornamental plant has special uses; in districts having a soil salt enough to prevent many garden plants from growing, *Asparagus* appears at home, and, in conjunction with *Eucharis* and "Spider Lilies," some very pretty combinations may be made. One ounce of *Asparagus* seed, if good, gives about 500 plants.

ASPARAGUS PLUMOSUS.—A charming South African species, which has become very popular in temperate climates; thrives in moist conservatories in northern districts or at an altitude of 3,000 to 7,000 feet. It may be raised from seed and increased by careful division of the crown.

ASPARAGUS RACEMOSUS—*Satavari, Sadabori, Satamuli*—is a charming indigenous hardy climber, with incurved, fascicled, three-sided leaves and recurved solitary thorns; its pretty little white flowers have a strong odour, agreeable at a little distance. Its medicinal properties are detailed in *Pharm. Ind.*, III. 483.

ASPARAGUS LÆVISSIMUS has larger leaves than other species, and a deep shining green colour.

ASPARAGUS GONOCADOS.

ASPARAGUS ADSCENDENS forms a bush showing little inclination to climb, its thorns are straight, and its roots dried are a popular medicine named *Saffed Mūsli*.

ASPIDISTRA¹ are perennial herbs with a creeping root-stock and upright leathery leaves, which in temperate climates bear the atmosphere of a dwelling-house better than plants generally do. The flowers are small, short-stalked from the root-stock. Re-potting with fresh turfy loam during spring is necessary.

ASPARAGUS ELATIOR has long-stalked leaves attaining 3 feet in height, frequently variegated with ivory white streaks.

¹ *Aspidistra*, from *aspidiseon*, a little round shield, in reference to the form of the flower.

ASPARAGUS LURIDA is dwarf, but resembles the above.

GARLIC—*Lasan*, *Vellulli*, *Alium sativum*.—The bulbs of Garlic consist of numerous smaller bulbs, which, being separated, serve as “seed,” and, planted during September to November on a thoroughly-tilled soil, are ready to lift ten weeks later. 738 lbs. per acre was the waste rate found in Satara district—this quantity was value for R.106 7 0, and its cost of production was R.40 12 7. It is highly valued in cookery, and is an ingredient in many sauces. “After intense fatigue, a clove of Garlic slowly chewed and swallowed acts as a powerful restorative.”—*Pharm. Ind.*, III., 489.

CORDYLINE.—A moist atmosphere is the first requisite, and, being forest plants, they are unable to thrive with direct tropical sunlight, but the shade must not be thickly abundant: diffused light is necessary to bring out the brilliant colour of the foliage. A soil consisting of loam from a river bank, enriched with decayed manure in liberal proportion, and kept open with sand or charcoal in coarse powder, generally suits them. As the maintenance of well-developed foliage rather than flowers is the object of cultivating those plants, planting in a prepared bed is better than pot culture for development, but the facility of moving the plant is lost. To propagate the plants, the head is first removed by tying leaf-mould round the stem with sacking and keeping it moist; in a few months roots will appear, and the head may be cut off and treated as a plant, the remainder of the stem may then be made into short cuttings and rooted in a close frame.

CORDYLINE AMBOYNENSIS (from the East Indian Archipelago) has lanceolate, deep bronzy-green leaves, the lower half with an edging of rosy-carmine, on petioles tinted with rosy-purple; it requires a moist climate.

CORDYLINE AUSTRALIS (from New Zealand) has white, crowded, sweet-scented flowers $\frac{3}{4}$ inch in width, and oblong, lanceolate leaves 2 to 3 feet long and 2 to 4

inches broad. A temperate species, adapted for well-sheltered conservatories at hill stations. C. A., variety DE GROOTI, has variegated leaves; variety DONCETTI has white edges, leaves $\frac{3}{4}$ inch by $2\frac{1}{2}$ to 3 feet.

CORDYLINE IMPERIALIS has leathery deep green leaves $1\frac{1}{2}$ to 2 feet long by 3 to 4 inches wide, of a metallic hue, with crimson rays.

CORDYLINE INDIVISA (from New Zealand).—A fine green-leaved species, abundant in gardens at 2,000 to 5,000 feet altitude, its leaves are 2 to 4 feet long and 3 to 4 inches wide, and gracefully curved, and, when well grown, there are few more decorative plants for temporary use in apartments. C. I. varieties:—ATROPURPUREA, LINEATA, VEITCHII, and VERA.

CORDYLINE TERMINALIS, with lanceolate, dark green, bronzy, and crimson leaves, is a species which has given rise to very many fine varieties.

CORDYLINE (DRACÆNA)¹ ARBOREA (from Northern Guinea) has an erect woody stem and a dense head of strap-shaped leaves $1\frac{1}{2}$ to 3 feet long by 2 to 3 inches wide in middle.

CORDYLINE CLUSII—*Dracaena*, *Draco*—when with a simple stem about 10 feet in height and a crowded head of lance-shaped leaves, is a most elegant decorative plant. It thrives in a mild climate approaching that of its home, the Canary Islands.

CORDYLINE (DRACÆNA) CINNABARI—the *Dragon's Blood Tree* (of Socotra Kharya).

CORDYLINE (DRACÆNA) FRAGRANS.—A tropical African species, with fragrant flowers and long lanceolate leaves elegantly recurved; grows well in a hot moist climate. Its variety, C. D. F. LINDLUI, has longitudinal bands of creamy-white and yellowish shackles the entire length of the leaf.

¹*Dracæna*, from *drakiana*, a female dragon.

CORDYLINE (DRACÆNA) GOLDIEANA is a very distinct type from tropical West Africa; its leaves are cordate-ovate, about 8 inches by 6 inches, marbled, and irregularly banded with dark green and silvery-grey bands in alternate lines.

CORDYLINE DRACÆAN GODSELFIANA is a slender bush with white variegation on margin of leaves 6 inches by 1 inch.

DIANELLA NEMOROSA.—An elegant plant attaining 3 feet in height, having a short, compressed woody stem, sword-shaped equitant bifarious leaves as in the Iris, and panicles of small blue lilies. It thrives at Calcutta, Poona, and in mild climates, on a border shaded from full sunshine and watered occasionally.

EICHHORNIA¹ **SPECIOSA**—*Brazilian Water Violet*.—A water plant, either floating with the orbicular leaves above the water by the aid of inflated leaf-stalks or growing in mud on shallow water with normal leaf-stalks, and in the latter position producing violet-coloured liliaceous flowers in racemes. With slight shade, it grows freely if placed in a tank.

FUNKIA SUB-CORDATA—*the White Day Lily*.—Having pure white fragrant flowers which expand at sunset and close in the morning, and large ovate-cordate, many-nerved leaves. Thrives with slight shade on a moist border at Calcutta.

GLORIOSA SUPERBA—*Kalavi, Nagli Indai, Kaliari, Languli, Kalappagadda, Radagari, Ulat-chandel*—grows wild in hedges in the Concan and other moist districts, and in the Deccan is of easy culture, only requiring to be planted at the root of a shrub with thin foliage and watered freely during the rainy season; but a grub climbs up the plant by night just before flowering time, eats off the top of the shoot, and disappears before day,

¹ *Eichhornia*, after J. H. Eichhorn, an eminent Prussian.

taking with it all hope of the brilliant blossom. This lily is specially adapted for cutting for house decoration, because the flower retains freshness and beauty for many days. The flower is pale yellow when newly opened, and gradually changes to a deep orange-red.

GLORIOSA VIRISCENS.—A tuberous climbing lily of tropical Africa, thriving in ordinary garden soil if kept moist between May and December.

HEMEROCALLIS FULVA—*the Day Lily, Gul-Nurgas.*—A yellow lily with bifarious, linear, keeled, acute leaves, grows freely with moist border treatment in Calcutta gardens.

HYACINTH and TULIP.—The importation of bulbs in good condition is now comparatively safe, especially if a passenger can be induced to add a few dozen to the luggage which is carried in his room. The bulbs being imported in autumn and potted in groups proportionate to the size of the pot, placed in shade, covered with a few inches of leaf-mould, and kept moist, roots will form and the flowers appear in due course. Direct exposure to the sun is not desirable, and the greatest success is obtained at 4,000 to 7,000 feet altitude.

KNIPHOFIA UVARIA—*the Tritonia or Torch Lily.*—A South African bulbous plant having a simple flower stem closely beset with orange-red flowers. It grows nicely with slight shade at 4,000 to 7,000 feet altitude, but the flowers are often destroyed by the monsoon.

LAPAGERIA ROSEA (and its white form, **L. ALBA.**)—A climbing shrub, from the mountains of Chili, having wiry stems bearing alternate leathery three- to five-nerved leaves and elegant pendulous lily flowers, durable when cut. It thrives at 3,000 to 7,000 feet altitude on the northern face of a house if planted in fibrous loam enriched with abundant manure and shell sand or lime rubbish, and may be propagated by seed and layers.



LAPAGERIA AND YUCCA GLORIOSA.

LEEK—*Allium porrum*, *Gandina*, *Taw-kyet-thwon*, *Korat*.—In northern districts having a rainfall under 30 inches, or more, if combined with an altitude of 2,000 feet, fair success in growing this valuable flavouring esculent may be attained by sowing fresh seeds during August and September on a bed of rich friable soil arranged for thorough watering. When the young plants have attained 5 to 6 inches, they should be transplanted to lines in shallow trenches 1 foot apart and 4 inches apart in the line. Abundant water must be given and the trenches filled with soil gradually as the plants grow up, then from between the lines earth should be drawn to the plants, to ensure a good length of blanched stalk; shade from afternoon sun is desirable, and it is advisable to enclose each plant in a tube of prepared paper.

LILIUM AURATUM (of Japan).—If strong bulbs of this fine lily are imported in April or May and grown in the conditions detailed for *L. neilgherrense*, a few of the very grand and durable flowers may be expected during the rainy season.

LILIUM GIGANTEUM.—If well-ripened bulbs of this grand lily are obtained from Sikkim in March or April and treated as detailed for *L. neilgherrense*, satisfactory results may be confidently predicted. It attains 10 feet in height, bears heart- or egg-shaped leaves, 1 to $\frac{1}{2}$ foot in length in channelled stalks as long as the leaves, and produces five to ten white flowers 5 to 6 inches in length and of 4 inches in expansion during August and September.

LILIUM NEILGHERRENSE.—A bulbous herb, producing simple stems 3 feet in height, bearing lance-shaped, shining, three- or five-nerved leaves 5 inches by $\frac{3}{4}$ inch and trumpet-shaped white flowers tinted with green on the outside, 8 inches in length and 5 inches in expansion at the mouth. A native of Nilghiri. Bulbs may be obtained from Ootacamund and planted in pots with rich friable soil, and during the rainy season kept in a moist atmosphere with slight shade.

ONION—*Peeaj*, *Allium cepa*.—Few vegetables are cultivated with more success in the dry parts of India than this wholesome esculent. The variety most generally grown resembles the common pale-red onion of Europe; it weighs $\frac{1}{2}$ lb. and is $2\frac{1}{2}$ inches in diameter. It is mostly depressed, globular in shape, but evidently little care has been given to secure uniformity. In colour it is pale-red outside and creamy-white, with purple streaks, inside. The skin is membranous and fragile and the flesh very firm. Its pungency is mild, and the bulbs keep well. White-skinned onions, which differ little from the pale-red sort, are grown near Dhulia, and also near Benares. For green onions, the seed may be sown twice a month throughout the year. In the rainy season provide thorough drainage, and during the hot season provide slight shade, protection from hot winds, and water once daily. For ripe onions, sow on a well-prepared seed bed in September or October, and when the plants are up a few inches, set 4 inches apart. The ground must be laid out for irrigation, and water given once a week in dry weather. To obtain seed, plant well-shaped ripe onions about the beginning of November. Poudrette is an excellent manure for onions: in its absence, ashes and decayed sweepings are suitable; it is important that the manure should be well mixed with the soil and that fresh seed only be sown, as the seed loses the germinating power very soon. At Khed Poona, one crop of onions was found to be—24,632 lbs. per acre, worth R. 198 12 0; another, 28,841 lbs. per acre, worth R. 231 4 0. In England, 45,000 lbs. per acre is often produced; and a crop of 70,000 lbs. per acre is reported. At Glasgow, the average price in spring is £5 per ton, the supply being from Egypt. A size of 18 inches circumference has been attained.

PHALANGIUM TUBEROSUM—*Kuli*—is a charming little white lily, resembling the Snowdrop, found on Deccan uplands. To secure this plant for the garden, mark a spot where it abounds while in flower and get the roots

dug up at the end of the hot season and planted with conditions approaching that of its natural habitat, that is, a thin soil and water equal to 25 inches during the rainy season. The tubers are eaten as a sacrament by Hindus.

POLYXENA TUBEROSA (formerly *Polianthes*)—*Gul-chaboo*.—The single and double varieties are common, and need no special culture in districts with moderate rainfall except frequent replanting.

REINECKIA CARNEA has a creeping rhizome, bearing erect lanceolate leaves attaining 6 inches by $\frac{1}{2}$ inch. The variety with striped leaves is very ornamental, and is useful for covering the floor of the conservatory, as it grows in such places without special care.

RUSCUS ACULEATUS—*the Butcher's Broom*.—A small shrub destitute of true leaves, but having expanded branchlets, which serve the purpose of leaves. It grows at the latitude of Bombay with 2,000 feet altitude, but is better with a cooler climate. Propagated by division of the root-stock. The bulbs are valued in medicine.—*Pharm. Ind.*, III., 493.

SANSEVIERA JAVANICA.—There is a pretty variety, *MACULATA*, having its leaves spotted or blotched with yellow.

SCILLA—several species. Are ornamental bulbous plants, having blue flowers, and adapted for 5,000 to 7,000 feet altitude with protection from sunshine.

SHALLOT—*Allium ascalonicum*, *Ghandura*, *Pulandu*, *Ek-kanda-lasan*.—The bulbs may be divided and planted on a bed of friable rich soil during August in dry districts, later if the rain is heavy, and watered when dry. It is much used in preparing pickles, being milder than the Onion.

YUCCA FILIFERA has a strong upright stem and greyish-green leaves $1\frac{1}{2}$ feet long by 1 to $1\frac{1}{2}$ inches broad and

large panicles of white flowers, pendulous from the top of the stem; freely produced at Hyderabad, Sind, and other northern stations.

YUCCA¹ GLORIOSA.—This is an aloe-like plant with lance-shaped leaves, and bearing, during April to August, a grand upright panicle of creamy-white flowers as large as a hen's egg, pendulous from the branches of the inflorescence. The inside of the flowers is of a purer white than the outside, and if the flower-leaves are gently turned outwards they remain in that position, resembling *Eucharis* lily when arranged on a table. If this plant be set out in poor soil or in a pot it may remain many years without flowering. To cause it to flower regularly every year in the dry parts of India, it needs nothing more than an ordinary rich garden soil, well drained, and abundant water during the rainy season. In moist districts it should be planted on a high mound of good soil mixed freely with stones and old manure. South of Bombay, 2,000 to 7,000 feet altitude, is desirable, with shelter during the monsoon. To propagate *Yucca*, the small shoots that spring from the base of a plant growing in poor soil may be cut off near or below the surface and planted as cuttings, or from a large well developed plant a few leaves may be cut off and good soil mixed with leaf-mould tied round the stem and watered regularly; soon roots will appear and the stem may be cut off and planted without danger.

YUCCA QUADRICOLOR resembles the above, but it is of smaller growth and has striped leaves, in which four shades may be seen. Its cultivation and propagation is similar to the above, but it rarely flowers.

YUCCA FILAMENTOSA is distinguished from *Yucca gloriosa* chiefly by the fibrous threads which margin the leaves and give the plant its popular name of "Adam's Needle and Thread." Its treatment is similar to that of *Yucca gloriosa*, detailed above.

¹ *Yucca*, the St. Domingo name.

ALISMACEÆ, *The Water-Plantain Family.*

A small group of water or marsh plants, producing showy flowers; of easy culture where shallow, sweet water is available.

ALISMA PLANTAGO has large, regular six-parted bisexual flowers.

SAGITTARIA SAGITTIFOLIA (of Europe) is an elegant plant with arrowhead-formed leaves on long stalks rising from the base, and pure white unisexual flowers in whorls of three on erect stalks; the flowers of each sex occupy separate stalks.

SAGITTARIA OBTUSIFOLIA has leaves rounded at the apex, and bisexual flowers.

BUTOMUS UMBELLATUS—*the Flowering Rush* (of Europe).—Has regular six-parted bisexual flowers on the end of a stout stalk.

LIMNOCHAERIS EMARGINATA (of tropical America).—Has leaves on the end of a triangular stalk rising from the mud, and showy yellow flowers on the end of a triangular stalk as long as the leaves.

MONOCHORIA VAGINALIS—*Nirocancha, Nouka, Nilotpalia*.—A water plant with narrow, heart-shaped, pointed, five- to seven-nerved leaves, 2 to 4 inches long, on tubular smooth stalks 6 to 12 inches long, and a short-stalked raceme of six-parted blue flowers.

MONOCHORIA HASTATA—*Niru-tamara*.—Resembles the above, but has triangular many-nerved leaves.

PONTADERIACEÆ.

A small group of water plants, easily managed wherever the climate is warm.

EICHORNEA—*the Water Hyacinth*.—A water plant of great beauty, but apt to become too common if the climate be suitable, as in New South Wales and Florida, where it chokes up rivers and generally does much injury.

COMMELINACEÆ,¹ *The Spiderwort Family*,

Is a group of herbs, including a few garden ornaments and some weeds which produce flowers *underground*. The plants which show this condition are *Commelina obliqua*, *Juta kanshira*, and *Commelina benghalensis*, *Kanshira*, *Kanuraka*, *Kana*. If these plants are dug up carefully, numerous flowers bearing perfect seeds will be found on underground branches; the plant also produces bright blue flowers in the open air, which rarely yield seed. What enemy is the plant seeking to delude by this strange device.

RHCEO DISCOLOR has upright pointed leaves, green on the inner, purple on the outer, side. When grown in a rich soil and regularly watered it is a striking plant, easily propagated by offsets.

RHCEO ZEBRINA—*Zebrina pendula*—has a creeping habit, and its striped leaves are very ornamental when grown in the moist shade of the fern-house; the silvery variety is specially elegant.

CYANOTIS—*Papilionacea*, *Kana*—is a pretty little plant, appearing on rocks in full sun, and of interest from the hairs on the filaments showing the movements of protoplasm with facility.

PALMÆ, *The Palm Family*.

The Cocconut, Betel-nut, Date, and Palmyra trees serve as types of this group of very graceful trees. In field cultivation a rich loamy soil with water within 10 feet of the surface is generally suitable, and for pot culture a compost of loamy soil, old cowdung, decayed leaves, and potsherds in equal parts should be mixed in a pit and kept in a moist state for at least six months before using. The pots should have the drainage carefully arranged, so

¹ *Commelinaceæ*, from the genus *commelina*, after Kaspar and Johann Commelin, Dutch botanists.

as to be effectual with little space. Give water freely while the plants are making growth, and while at rest give only as much as will keep the soil moist. The



CORYPHA UMBRACULARIA IN FLOWER.

species noted are desirable garden plants. Propagation is generally by seed, but a few may be increased by division of the root-stock.

A peculiarity in their germination of general occurrence requires noting. The seed produces a shoot which usually goes downward, but often runs on the surface, the length of this varies from a few inches to several feet; at the free end a bud is developed, from which the stem grows upwards and roots are produced. The pressure of the roots on the pot in attempting to pass downward often raises this part, the *hypocotyl*, above the surface, and if it appears, it should be allowed to remain.

ACTINORHYTIS CALAPPARIA—*Ram supari*—resembles *Areca catechu* generally, but is stouter in the stem, and its leaf-divisions are obliquely toothed at the apex and have thickened margins; its flower-branches issue a little lower than the insertion of the leaves; its ripe fruit is purple, and the seed is 2 inches diameter. Its cultivation is similar to that of *Supari*.

ATTALEA COHUNE (of Honduras) has feather leaves from the base and thrives with shade and moisture.

ATTALEA FUNIFERA—the *Paissave fibre Palm* (of Tropical America)—from which street brooms are made, is a feather-leaved palm bearing fibre between the leaves. Propagated from seed in warm, moist regions.

ARCHONTOPHŒNIX¹ CUNNINGHAMIANA—the *Illawara Palm* (from Queensland), formerly known as *Seaforthia elegans*.—A tall, slender, smooth-stemmed, feather-leaved palm, with the pinnæ narrow lanceolate, 1 to 1½ feet long, green and unequally bifid at the apex. Upwards, the stem is enclosed in smooth green leaf-sheaths, and, while mature, almost continually bears ivory-white, short, pendulous flower branches decorated with red berries, from the base of the oldest leaves. This palm thrives especially on the latitude of Bombay, at 2,000 feet altitude, fully exposed, and on rich soil occasionally irrigated. Corresponding latitudes northward and southward suit it, but, with the aid of slight protection, it is cultivated in cool climates.

¹ *Archontophœnix*, princely date tree.

ARECA CATECHU¹—*the Betel Palm, Supari, Pung, Adiki*—has a smooth, straight, ringed stem about 5 inches in diameter, growing to a height of 60 feet, and crowned by feathery leaves having the divisions pointed at the apex; and has male and female flowers on the same tree. For commercial cultivation of the Betel-nut, a moist climate is essential, and the soil should be a rich, sandy loam, with sufficient water available to keep the soil moist, yet with good drainage and protection from floods which would wash away the best of the soil. The necessary drainage is generally secured by opening trenches and using the excavated soil as a surface dressing—the irrigation channels alternating with the drains being carried along the higher lines. The plants are raised from entire fruits, gathered ripe in October and November, dried in the sun, and planted in January or February, 6 inches deep in leaf mould, and kept moist. When eighteen months to three years old, the plants are fit to set out at intervals of 4 feet in lines 8 feet apart. If the soil be very sandy, the plants are set in pits 2 feet deep, but on good loam a depth of 6 inches is sufficient. Between the lines, Bananas are planted to give shade to the young palms; but when the palms have exceeded the height of a man, the Banana plants are removed, and, if the altitude be sufficient, Pepper and Cardamons are set between the lines. Fruit bearing sets in about the fifth year if the growth has been favourable: the average annual crop per tree is about 250 nuts, and, allowing for open trenches, the trees may be 1,000 per acre. The nuts may be gathered three times yearly; the degree of ripeness necessary varies greatly with the intended market, and the nuts, either entire or sliced, are sometimes boiled in milk and water. There are several local varieties of Betel-nut, but the chief difference in the market supplies depends on the degree of ripeness when gathered and local climate and

¹*Areca*, from its Malabar name. *Catechu*, one of the sources of the astringent extract catechu.



ARENGA WIGHTII.

treatment, but one sort, *Ram supari*, is the produce of a distinct tree, *Actinorhytis calapparia*, said to be indigenous to the Malayan Archipelago. The Betel-nut palm is subject to the ravages of a scale insect which reduced the profit of the Shrivardhan plantations during several years to the vanishing point. If within reach of a spray, the frequent application of kerosene-soap mixture is effective.

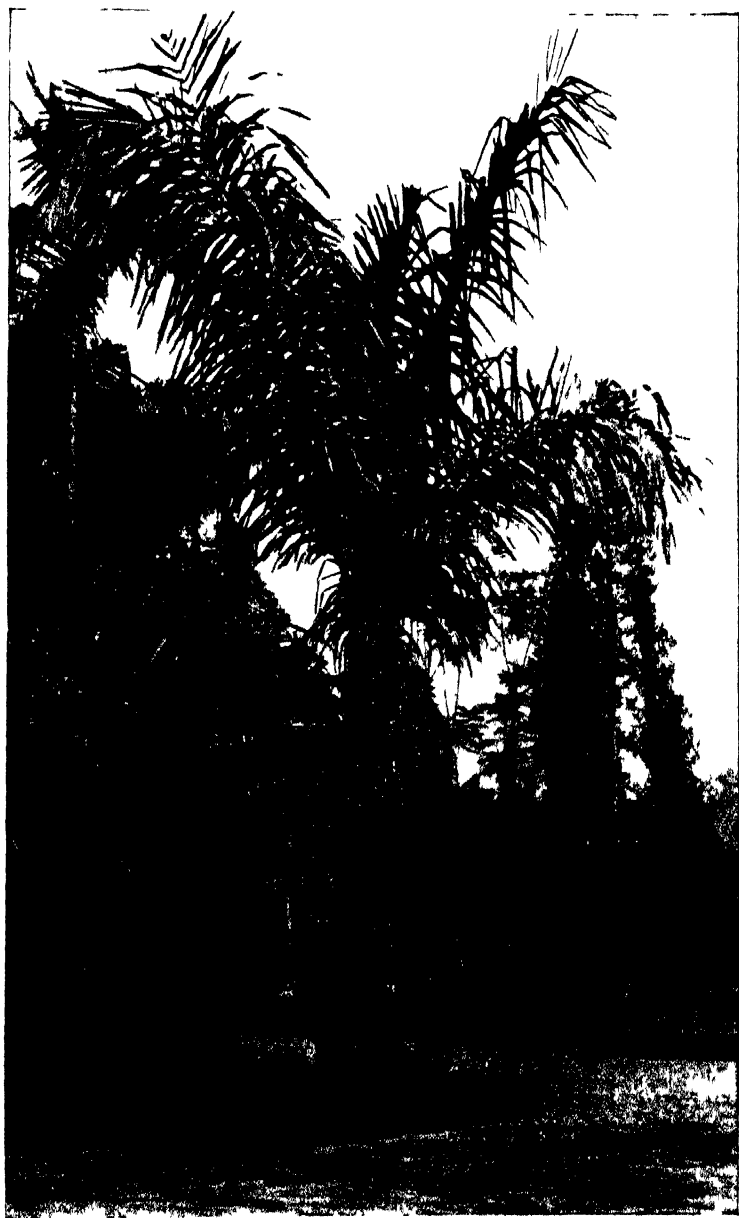
An interesting note may be made, that the large *suparee* (*Ram-supari*) of our bazaars is the produce of a distinct tree.

ARENGA WIGHTII—*Dudasal*.—A large palm of the feather-leaved type, having the stem clothed with the fibrous remains of leaf-sheaths and rarely producing off-sets from the base. The leaves extend nearly erect, are very pale while young, but gradually become green on the upper and white on the lower face; the segments are separate and lobed at the base, the lower side having the larger lobe. Its natural habitat is the moist forests of Northern Kanara, and it thrives in gardens on rich soil occasionally irrigated. It is propagated by seed, and flowering begins at the top when the plant has attained full growth, and progresses downward, as in *Caryota urens*.

ARENGA SACCHARIFERA.—A palm having enormous shining, dark green pinnate leaves with a graceful curve towards the summit. It thrives in gardens throughout the plains. In Moluccas Islands, sago is made from its stem and sugar from its sap.

BACULARIA MONOSTACHYA—*Walking-stick Palm* (of New South Wales)—has a slender stem, 12 feet high, bearing feather leaves, whitish beneath, toothed at ends of pinnæ. It is fit for the dry parts of India at 2,000 feet altitude.

BORASSUS FLABELLIFER—*Brab, Palmyra, Tad, Tadi, Tarh, Tal Tali; Carimpana, the female; Ampara, the male*.—This grand palm is not much used in gardens; it takes up much space, and generally looks unhappy com-



ARENCA SACCHARIFERA.

pared with the same species on hill sides, where its tall cylindrical stem crowned with immense fan-shaped leaves is a grand feature in the landscape. But in the Botanical Gardens at Calcutta a special use has been found for which it is well adapted. On the outskirts of the garden a winding path, about 12 feet in width, has this palm planted near the sides about 10 feet apart; the effect of the thick stems ornamented by the persistent leaf-stalks is strangely happy. To grow this palm quickly, a moist climate is necessary, and the seed should be sown where it is required to grow, because it first sends a shoot downwards to a depth of 3 to 4 feet, and from the bottom of this shoot, the bud which forms the stem is developed. The timber of this tree is said to be proof against termites and to be useful in building.

CALAMUS.—An interesting genus of palms, chiefly climbing, and armed with strong spines, the stems forming the canes once familiar to schoolboys and used in chair bottoms. While young, the plants are remarkably graceful, and, if permitted to climb trees, the elegant effect is retained; but several species develop long whips, armed with recurved thorns, which are disagreeable if within reach. A very moist hot climate and a rich forest soil, with shade, is desirable for their cultivation.

CALAMUS PALEMBANICUS.

CALAMUS PSEUDOTENUIS.

CALAMUS TWAITESII—*Handibet*—is erect, and abundant in the moist forests of Northern Kanara.

CALAMUS ROTANG—*Bet*, *Sanchi-bet*—although graceful while young, soon develops dreadful whip-like tentacles armed with sharp recurved thorns, and is fit only for large gardens; its stem is the chief source of canes.

CARYOTA URENS¹—*Birly Mhad*, *Jeerogoo*, *Scunda pana*, *Kitul*, *Cey*.—This fine palm, described elsewhere,

¹ *Caryota*, the Greek name of a kind of date. *Urens*, burning from its acrid fruit.



CARYOTA URENS

is a native of wet mountainous districts, and in gardens thrives with ordinary border treatment. In Ceylon it yields palm wine and sugar, and Kitul fibre is now a commercial product. This is one of the few palms that have twice-pinnate leaves, and the leaflets are abruptly terminated; it does not flower until it has attained full height, and the flowers not only are from the long branches of a hanging raceme, but those are themselves produced in downward succession.

CARYOTA resembles the *Birly Mhad*, *Caryota urens*, in its triangular leaflets abruptly terminated and resembling the dorsal fin of some fishes, but is distinguished by the several stems this plant produces, while in the *Birly Mhad* the stem is solitary.

CHAMÆDorea OBLONGATA (from Brazil) has slender stem and feather-leaves, with pinnæ 3 to 4 inches broad.

CHAMÆDorea WOBSTRIANA has feather-leaves with leaflets $\frac{1}{2}$ inch broad.

CHRYsalidocarpus LUTESCENS is a very handsome pinnate-leaved palm producing offsets near the base of the stem. It grows nicely in conservatories, and at Madras succeeds well on the bank of a tank. It is a palm of convenient size for temporary room decoration.

COCOS NUCIFERA¹—*Nariel*, *Tenga*, *Narikel*, *Narikadan*, *Kobri-chalu*.—A well-known handsome palm, with feathery leaves and a smooth stem which is never straight. It thrives especially on the coast within reach of high tides, but may be cultivated inland on a rich alluvial soil with abundant water; but the cost of cultivation inland lowers the profit greatly. Plants are raised from the large nut planted with its husk. The nuts for seed are matured on the tree, gathered carefully during the early hot months and hung up in the house where

¹ *Cocos*, very doubtful, from *coco*, Portuguese for monkey, from the three circular depressions on one end.—See *Annals of Botany*, Part II., page 184. *Nucifera*, nut-bearing.

the kernel may ripen, with protection from ants which would suck the sweet sap, and when the monsoon arrives, are placed in a well where, floating, they will germinate ; or may be set 1 foot apart in sandy soil with abundant wood-ash, and water sufficient to keep the soil moist, the nut being placed on its side as nature has provided. The germinating cocoanut develops a sweet mass of cellular tissue in the hollow centre of the large seed, termed *phul*, which is eaten as a delicacy by the people, and needs protection from ants, as indicated above. When one or two years of age, with leaves about 3 feet in height, the young palms may be set in the permanent quarters during July. The distance apart may be 18 to 25 feet in rich soil, in lines alternating so that each of the inward trees is the centre of a cross formed by four others. The young trees must be firmly planted with soil dry enough not to become water-tight when firmly trodden while planting, and sheltered with palm leaves to prevent motion until well rooted, and must be watered, at least during the first year, at intervals short enough to keep the soil generally moist. When practicable, an irrigated and freely manured crop should be grown between the cocoanut trees during the first few years. In any case, the soil should not be allowed to remain dry for more than a day or so during the first year. The most successful plantations have a constant water level 10 feet from the surface and at high tides have water conveyed throughout by canals, which may be blocked or left open as the seasons demand. Stagnation must be avoided, and either brackish or sweet water is suitable. When the trees are well established by a few years' growth, heavy dressings of dry fish or other nitrogenous manure may be given during the hot season, the manure to be thoroughly covered with clean soil to prevent beetles from depositing eggs in it which develop into large wood-boring grubs, and an embankment formed in a circle round the base of the stem to cause rain-water to soak into instead of running off the ground ; a constant search for grubs, with a stout wire to prod holes and

clay to stop the entrance, is desirable. If well grown, fruit bearing begins at from five to seven years of age, and the yield of nuts from established trees varies from 120 to 200 yearly, which are worth from R. 40 to R. 55 per 1,000, or a nett income of R. 2 to R. 3 per tree. For *Copra*, nuts are ripened on the tree and dried in the sun six weeks, then the *copra* being cut out, dries quickly and does not turn mouldy. In the neighbourhood of a large city, a considerable income may be obtained from the toddy: at Bombay it is estimated at the high rate of R. 323 per acre to the cultivating landowner.

Cocoanut Beetle.

The larvæ of the *Rhinoceros Beetle* is a serious enemy of the cocoanut tree. The beetle lays eggs in the manure and the larvæ eats its way into all tender parts of the tree, often destroying the terminal bud and killing the tree. To prevent its action, manure that has been lying exposed during the rainy season, and probably has grubs in it, should be watered freely with lime water to bring the larvæ to the surface, and domestic poultry or crows invited to do the rest, and all holes probed with a wire and stopped; where the water is brackish, this beetle is not destructive. *Xylotripes gidion*, and other species of the genus are destructive in Malacca. Prodding is the most reliable means of destroying the vermin.

COCOS PLUMOSUS (from Brazil) has a straight stem and pinnate leaves 20 feet in length, standing upright and recurved at the end, forming a graceful plume; the pinnæ are 18 inches in length and $\frac{3}{4}$ inch in breadth.

COCOS WEDDELIANA.—A very graceful small palm of the feather-leaf type, of slow growth, and having the stem clothed with the remains of leaf-sheaths, the leaves ascending and arching gracefully, and the segments long, narrow, dark green, pointed at the apex. It thrives in the Deccan in the shelter of a conservatory, and is propagated by imported seed. During the first few years of growth, this palm is one of the most graceful table plants,



CORYPHA UMBRACULARIA,
With Beaumontia Grandiflora on stem.

if grown in a small pot; and when it has attained 3 to 4 feet in height, in an 8-inch pot, it is one of the finest drawing-room plants, and requires a pedestal for its display.

COCOS CORONATA (from Brazil).

COCOS PROPINUA (from Brazil).

COCOS ERIOSPATHA, temperate climate, 4,000 to 7,000 feet altitude.

COLEOSPADIX ONONIS (of New Guinea).—A small palm, having leaves with long wedge-shaped leaflets, the greater breadth being outward, and the ends oblique and toothed.

CORYPHA UMBRACULIFERA—*Talipot, Tali, Shri-tali*.—A majestic fan-leaved palm, frequent in southern moist countries, which produces an immense flower branch from the top of the stem once only, which terminates the existence of the tree. It thrives in moist districts, from Bombay southwards.

CYRTOSTACHYS RENDA (from Sumatra) has red leaf-stalks, otherwise resembles the Areca nut palm.

DÆMONOROPS PLUMOSUS.—A small plant with slender stem and pinnate leaves, having the sheathing petioles armed with stout black spines which are white at the base. It thrives in the Botanical Gardens, Calcutta, and the Victoria Gardens, Bombay.

DYPSIS¹ MADAGASCARIENSIS.—A dwarf palm with pinnatisect leaves having few pinnæ cleft at the apex. It grows slowly in the conservatory.

ELÆIS GUINEENSIS—*the Oil Palm of Africa*.—Thrives in the very hot moist region within 10° of the equator in West Africa on rich moist soil near water, and grows fairly in gardens at Bombay, where its dense head of narrow feather-leaves is highly ornamental.

¹ *Dypsis*, from *duplo*, to dip.

EUTERPE¹ OLERACEA, called the *Cabbage Palm*, because the terminal bud may be cut and eaten as cabbage, at the cost of the life of the tree. It has pinnate leaves, the segments lanceolate linear, acuminate glabrescent, and the leaf-sheath long, cylindrical, pale green, finally falling with the rest of the leaf.

DIPLOPAEMIUM CANDESCENS (from Brazil) is a feather-leaved palm, producing a short robust stem. It grows without special treatment in shade, moisture, and heat.

EXORHIZA WENDLANDIANA (from Fiji) is a feather-leaved palm with a smooth stem, producing flowers below the leaves. It is fit for a moist climate without extremes of temperature.

HETEROSPATHE ELATA.—A graceful small palm with a smooth stem and feather leaves, having long segments tapering to a fine point. It thrives in tubs with thorough drainage, and a compost of good loam $\frac{1}{2}$, old stable manure $\frac{1}{4}$, crushed bones $\frac{1}{8}$, and charcoal in small pieces $\frac{1}{8}$. The climate at Poona, Bombay, and Calcutta, with slight shelter, suits it.

HYDRIASTELE² WENDLANDIANA.—A handsome pinnate-leaved palm having the ends of the pinnæ irregularly toothed, the tooth on the upper edge being about $1\frac{1}{2}$ inches in length. It thrives well in a conservatory, but its hardihood in full exposure to the sun has not been as yet generally proved.

HYOPHORBE³ VERSCHAFFELTII has leaves 4 to 6 feet long, nearly erect, pinnate, gracefully arching at the top. The pinnæ linear, lanceolate, acuminate, $1\frac{1}{2}$ to 2 feet in length and 1 inch broad, with a white midrib. The sheaths of the leaves form a triangular columnar stem. Specimens may be seen in conservatories in Indian gardens, but it grows very slowly.

¹ *Euterpe*, from *euterpes*, well-pleasing, one of the Nine Muses.

² *Hydriastele*: *hydria*, water, *stele*, a column; in allusion to the tall stems growing near springs.

³ *Hyophorbe*, hog's food, in allusion to the food being eaten by hogs.

HYPHÆNE THEBIACA¹—*the Doum Palm of Upper Egypt*.—This palm has fan-shaped leaves, and is remarkable for the long smooth stem dividing into 3 to 4



HYPHÆNE THEBIACA.

branches at a considerable distance from the ground. It thrives from Bombay to Lahore at low altitudes, and is a picturesque tree when well developed.

¹ *Hyphæne*, from *hyphaino*, to entwine, in allusion to the fibres of the fruit. *Thebiaca*, from *Thebes*.

JUBÆA SPECTABILIS (from Chili), with an unusually thick stem and feather-leaves; needs a cool climate and abundant moisture.

LATANIA GLAUCOPHYLLA—syn. *L. loddigesii*.—A very handsome fan-leaved palm having bright green leaves split into broad segments, and carried on glaucous, stout petioles tinged red while young, and from 2 to 8 feet in length. It is highly decorative in a moist climate, and needs conservatory protection at Calcutta while young.

LATANIA VERSCHAFFELTII—syn. *L. aurea*.—A fan-leaved yellowish-tinted palm having circular leaves, deeply incised, the ribs of the segments yellowish and the petiole of an orange colour and smooth, and from 2 to 4 feet long. In this climate it proves of slow growth, but bears full exposure well.

LIGUALA PELTATA.¹—A dwarf palm, native of mountains near Chittagong. Its leaves are fan-shaped, circular, and divided to the base into twenty to twenty-five wedge-shaped plaited portions, which terminate abruptly, and toothed leaf-stalks, nearly triangular, the sides armed with strong, sharp, smooth, recurved thorns inserted within the margin of the leaf-blade.

KENTOPSIS MACOCARPA (from New Caledonia).—Has much the aspect of a very large cocoanut tree, and the same treatment suits it.

KOSTHALSIA ROBUSTA.—A handsome, small palm of 8 feet high, armed with recurved spines, in groups, on the under side of feather leaves.

LICUALA RUMPHII—*Licuala spinosa*.—A small palm, with a slender spiny stem, fan-shaped leaves with linear segments terminating abruptly. It thrives in moist climates or in conservatories, with slight shade, and is propagated by seed.

¹ *Peltata*, having the leaf-stalk inserted within the margin.

LINOSPADIX MICHOLITZII (from Malaya) is a small, dense palm without stem above ground. Two-partite plaited leaves, 3 feet in length.

LINOSPADIX PETRIKIANA (from New Guinea) has smooth stem, $1\frac{1}{2}$ inches thick, bearing pinnate leaves and shoots from base.

LIVISTONA AUSTRALIS—*Corypha australis*—is a fan palm, with smaller leaves, but differing little in aspect from *Livistona chinense*, and thrives under the conditions favourable to that plant.

LIVISTONA CHINENSIS.—Has grand fan-shaped leaves, gracefully disposed on long petioles, armed with short recurved spines, and rising from a net-work of brown fibre. The length of the petiole varies with the position of the plant, being longer in slight shade than in the open. This palm does well with ordinary border treatment throughout India if watered freely during dry weather.

LODOICEA SECELLARUM—*Darya-ka-narel*, *Kadad rengary*, *Coca-de-mer*.—An interesting Seychelle Islands palm, intermediate between the fan-leaved and the feather-leaved type, with leaves, while young, 6 feet by 6 feet, gracefully recurved. The shell of the fruit, cut into four, is used as a begging dish by fakirs. The nuts weigh 10 lbs., and are frequently imported to Bombay, and a few are found to grow in a moist atmosphere without extremes of temperature. One has grown at Paradeniya, Ceylon, for forty years. The seed should be placed on a bed of deep, sandy soil, and covered with wood ash (to keep away ants) and grass, and kept moist. A shoot will appear and pass two or three feet along the surface and the end will turn upward; roots will appear at the lower side and leaves at the upper. There is at present a healthy plant at Kew about five years old. The wood ash covering must be renewed about every month, as the potash dissolves, and it is believed this is the effective part of the wood ash.

MARTINEZIA CARYOTÆFOLIA.—*Kattu-kital* (Ceylon).—A palm, native of moist districts of Ceylon, having pinnæ resembling *Caryota urens*, but armed on the backs of the leaves, the petioles, and stem, with long black spines. It thrives in the moist atmosphere of the conservatory in the Botanical Gardens, Calcutta.

MAXIMILIANA MARTIANA.—A South American palm having pinnate leaves, with large, nearly erect, leaflets when young. A handsome decorative plant, which thrives in the conservatory of the Botanical Gardens, Calcutta.

NANNOROPS RITCHIANA.—A fan-leaved palm of North-west India, with a very short underground stem and leaves of a pale green colour. It thrives in dry districts and loose, stony soil. The leaves of a plant seven years in cultivation extend only 3 feet from the ground.

NIPA FRUTICANS.—A marsh palm, having a horizontal stem and pinnatisect leaves of great length. It is suitable for the low banks of a tank.

OREODOXY REGIA.—A very grand pinnate-leaved palm, with leaves 5 to 6 feet in length, having pinnæ 12 to 18 inches in length and 1 inch in breadth, forked at the apex, bright green, and arranged in opposite groups of two, three, or five. The lowest pinna is often produced into a long pendulous whip 3 to 5 feet in length, and in medium-sized plants this is the most easy means of determination. This palm is not as common as it might be, as it thrives in a great variety of climates, and the landscape effect of an avenue of this species is very grand. Fully developed avenues of this palm are among the chief ornaments of the Botanical Gardens at Calcutta and Paradeniya, Ceylon, and good specimens may be seen in the Victoria Gardens, Bombay, and at Poona. At Calcutta, the avenues are both wide and straight and narrow and winding, and in either case the effect is grand. Although it grows well in a dry climate, fine

results have hitherto been attained only in moist districts, and at Poona it is benefited by abundant water.

PHŒNIX RUPICOLA is a graceful small palm. It develops a stem slowly, "and wide-spreading, arching, pinnate leaves broadly lance-shaped in outline with long narrow pinnæ," which are unfolded and display a bright green surface with a pale margin.

PHYTCLÉPHAS MACROCARPUM—*the Vegetable Ivory of Central America*.—This palm with abnormal flowers, which in the female has a four-celled ovary, is otherwise a palm with a creeping stem and large pinnate leaves. It grows nicely in a hot moist climate, such as Madras.

PINANGA DICKSONII.—A palm of the feather-leaf type, with the upper segments confluent and a ringed green stem, 1 to 2 inches in diameter, having shoots from the base; gregarious in moist districts of N. Kanara; shade and moisture with ordinary soil. Propagated by seed.

PINANGA MALAYANA (from Malay), with a ringed stem 1 inch in diameter and feather leaves with pinnæ in adherent groups and shorter empty spaces and bifid at apex, with shoots from the base.

PLECTOCOMIA ASSAMICA.—An elegant slender palm, having leaves white on the lower face and bifid while the plant is young, but ultimately pinnate and bearing long whips armed with recurved strong spines. It grows freely in rich soil with moist atmosphere and shade while young.

PTYCHOCOCCUS PARADOXUS (of New Guinea).—A feather-leaved palm with smooth stem 10 feet in height and 3 inches in diameter at the base. A valuable decorative palm. Needs moist air and heat.

PTYCHOSPERMA MACARTHURII (of Tropical Australia) has a smooth stem with suckers, and feather leaves with the leaflets in groups.

PTYCOSPHERMA ORNATA (from Tropical Oceania).—Small palm with smooth-ringed stem bearing feather leaves and shoots from the base.

DATE TREE (*Kujur*)—*Phœnix dactylifera*.¹

The date is cultivated in the part of Arabia from the latitude of Medina southward—the great date belt extending between the twenty-seventh and the twenty-second degrees—and near Bussorah, in Asiatic Turkey, where it is planted in continuous groves for seventy miles along the banks of the river Shut-el-Arab. Also in Northern Egypt and Tunis the cultivation is extensive, and is more or less carried on throughout the region embraced within the limits defined. The climate of those countries may be described as *hot and dry* during summer and autumn, and *cool and rainy* during winter and spring, a few degrees of frost occurring at night occasionally during the cold season, but always with a clear, dry atmosphere and irrigation water available to maintain sufficient moisture in the soil. The Arabs faithfully describe the necessary conditions for fecundity of the date tree as having its head in fire and its feet in water. An open sandy alluvium is the soil most generally suitable.

Many distinct varieties of the date tree are in cultivation, and as those are propagated by offsets that appear near the base of the stem, the varieties remain constant, and usually have such distinct foliage that the date-bearing forms were long considered a species distinct from the widely distributed wild type. De Candolle has described the date-bearing and the wild form as one species, and the writer raised a plantation from seeds taken from dates of very superior quality, and the result was a few date palms and a large proportion of *Sindi*, or trees of the wild form, named *Phœnix sylvestris*.

The best known date-bearing forms have the divisions of the leaf arranged in two ranks lateral to the axis of the leaf and pointing forward; they have also a specially leathery texture and smooth surface; while the

¹ *Phœnix*, the Greek name of the date tree, used by Theophrastus. *Dactylifera*, date-bearing.

trees raised from seed of the finest varieties of date include some with foliage as described and a large proportion having the leaf divisions directed not only laterally but upward, making several irregular ranks, some pointing toward the apex, others toward the base, and in all intermediate directions. The lower pinnæ are usually short and spinous. The seedling forms are very abundant in India, and are cultivated under the name *Sindi*, for the palm-wine which bears the same name, but the date-bearing forms are scarce. A few occur in gardens at Lucknow and near the University, Bombay, but within the influence of the south-west monsoon, although the tree grows well, no fruit worth consideration has been obtained or may be expected. In parts of Sind the conditions necessary for successful date cultivation prevail, and an extension has often been recommended in that country.

The Arabian varieties of date cultivated are—*Sihani*, yellow, stringy; *Birni*, red, succulent; *Jabeli*, upland, the staple exported; *Neid*, finest, 2 inches in length; *Kholas*, amber-coloured, and of exquisite flavour.

The date tree has the sexes on separate individuals, and the male flowers are usually cut from one tree and suspended among the female forms on another tree. The male flowers may be carried a considerable distance for the purpose of fecundating the female flowers, and may even be kept from one year to another and retain efficiency. The distribution of the pollen to the individual flowers will be effected by bees, wasps, house-flies, and ants, and should the presence of those insects not be evident, a little syrup of date sugar applied near the flowers will attract them. The flowering season is spring, and the fruit gathering begins in September and continues six or eight weeks.

As a nutritious food, the date has few rivals among fruit. Some qualities are used for the preparation of alcoholic liquor, and the seed has been exploited as a substitute for coffee.

To propagate the cultivated fruit-bearing sorts, the

offsets are removed carefully in autumn, with some roots if possible; the leaves are drawn together and enclosed in a mat, and the base firmly planted, at 20 feet intervals, in carefully stirred soil, shaded with date leaves inserted in the earth round the offset and tied together at the top, and watered at intervals sufficient to maintain a moist condition. In the dry atmosphere in which the tree thrives, abundant irrigation is necessary to ensure fruitfulness, and fresh soil, mixed with as much manure as is procurable, is arranged round the base of the tree, and soon becomes a mass of roots, which arise from the base of the stem.

To propagate seedling date trees, the seed with, or recently removed from its pulp is sown sparsely in rich, loose soil, covered with a layer of leaf mould about 3 inches in depth, and watered regularly. When 6 inches high, the little plants may be transplanted carefully, 2 feet apart; and when 2 feet in height has been attained, and the leaves are all firmly developed, the plants may be set out in their final position, 15 feet apart, with an irrigated crop occupying the intervening space. If near a large town, the value of an established plantation of *Sindi* trees is very considerable, from the crop of palm wine obtained.

PHŒNIX ACAULIS is a very graceful small palm of a delicate style of growth that renders it a special acquisition in gardens. It is not absolutely stemless; in its native habitat plants with stems 10 feet in height are common, but those must be of considerable age, as a fine specimen at Ganesh Khind, known to be at least twenty years old, has a stem 3 feet in height. Its leaves resemble those of the date palm in form, but are more slender and of thinner texture.

PHŒNIX ROBUSTA—Shalu.—A palm of very graceful habit, with slender leaves of a delicate bright green, which break off, leaving spirally arranged leaf bases covering the stem completely, if not rubbed off by the people who collect its leaves for preparing the well-



PHŒNIX ROBUSTA.
The Date Matting Palm of Bombay.

known "date" matting. In the Calcutta Botanical Gardens there is a fine specimen with its stem vesture complete, and on the Western Ghats, near Khor Barsa, there are numerous examples so completely denuded of this coating that it requires a patient search to find any remnants left. This palm is now abundant in gardens, and there are few more satisfactory ornamental plants. It is raised from seed, and thrives with pot culture under slight shade or in the open with occasional irrigation.

RAVENEA HILDEBRANTII (of Comora Island) is a small feather-leaved palm with a smooth stem, swollen at the base, bearing at first bifid leaves, the midrib ending in thread, then feather-leaved. Shade and a moist climate is necessary.

RHAPIS FLABELLIFORMIS (from China) is a palm having small fan-shaped leaves divided to the base into about nine linear segments irregularly and abruptly cut off at the end. It thrives in moist shade from sea level to 5,000 feet altitude, and sends up numerous stems, which are useful for cutting for decoration and as canes. Propagated by division.

RHOPALOSTYLE BAUERI (of Norfolk Island), long known as *Areca baueri*, has the aspect of the Betel-nut tree, with its smooth stem and feather-shaped leaves, and is a fine palm for garden use in warm climates.

SABAL BLACKBURNIANA (of Bermuda), a tall, unarmed, fan-leaved palm, with a reflecting spot at the base of the leaf-stalk and the linear segments bifid.

SABAL SANDFORDI (of Florida) has fan-shaped leaves, with a bright spot at the base of the leaf-stalk and threads near the centre of the leaf.

STEVENSONIA GRANDIFOLIA (of Seychelles) is between the fan and the feather type of leaf, thorny while young. The limb of the leaf bifid, recurved, and the stalk plane on one face, round on the other. One of the first-class among palms. Needs shade and moist air. Propagated by seed.

THRINAX RADIATA (of Chili).—A dwarf fan palm having circular leaves, with the leaflets united about half length, and in some of the leaves the lowest pinnæ remain united, making the leaf peltate. Occurs in conservatories in both moist and dry districts.

TRACHYCARPUS EXCELSA (of Himalaya, China, and Japan).—A palm fit for mountains above 5,000 feet altitude in the Tropics, as a few degrees of frost do not injure it.

TRACHYCARPUS MARTIANA.

WALLICHIA DENSIFLORA (from East Nepal), a feather-leaved dwarf palm, with leaflets in dense groups and white beneath inflorescence; a radicle raceme.

WALLICHIA CARYOTOIDES (of Sikkim).—In Calcutta Botanical Gardens, with leaves like *Caryote*, but white beneath.

WASHINGTONIA FILIFERA (of California).—A grand palm, having large circular fan-shaped leaves, with the segments separated half way down and the margins fringed with numerous white threads. The petioles are armed with stout hooked marginal spines, which are partly curved forward and partly backward. It thrives with open garden treatment in the Deccan.

HYDROCHARIDEÆ,¹ *The Frog Bit Family.*

This family includes some water-weeds that should be cultivated in small ponds in every garden, because, as Oliver observes—"The submerged leaves of several species of this family are well suited to show the rotation of the cell-sap in their individual cells. To observe it, place thin longitudinal sections or the membranous margin of a leaf under a high magnifying power." This is clearly apparent during the months of February to

¹ *Hydrocharideæ*, Greek, delighting in water.

June in *Vallisneria*, through a microscope with a $\frac{1}{4}$ inch object glass. Water plants generally are remarkable for their wide distribution.

HYDRILLA VERTICILLATA.—A common water plant, having long slender branches bearing leaves $\frac{1}{4}$ inch by $\frac{1}{16}$ inch in whorls of three to eight. It is elegant and interesting in drawing-room aquaria, and the leaf placed under a microscope shows rotation of the protoplasm in the cells. In the garden tank it grows too rapidly.

BLYXA is a grass-like water-plant, very like *Vallisneria*, and fit to place under the microscope with $\frac{1}{4}$ inch lens without any cutting ; it shows the rotation of protoplasm nicely.

OTTELIA INDICA, a submerged plant, with large, heart-shaped, many-nerved, membranous leaves on three-sided stalks and white flowers. Worthy of a place in the garden pond.

VALLISNERIA SPIRALIS¹—*Ganj, Russna ganj.*—Is easily distinguished by its long, narrow, grass-like leaves and the slender spiral stalk of the female flower, which permits the flower to float on the surface in varying depths of water, and the male flowers break loose and float in sufficient numbers to whiten the surface. It is plentiful in quiet streams at 2,000 feet altitude, and thrives in ponds with mud at the bottom and the water not quite stagnant.

PANDANACEÆ,² *The Screw Pine Family.*

A small group of plants represented by the familiar *Pandanus odoratissimus*, *Keura*. The family enjoys a very rich sandy soil, with abundant water throughout the year, and is propagated by seed or division. The plants freely produce large aerial roots bearing on the

¹ *Vallisneria*, in honour of Valisneri, an Italian botanist. *Spiralis*, referring to the spiral stalk of the female flowers.

² *Pandanaceæ*, from *Pandung* (Malay), conspicuous.

end the root cap (*pileorhiza*), which is one of the chief distinctions between the root and the stem. Abundant moisture is the only special requisite in cultivation.

PANDANUS BAPTISTII has the graceful habit of *Putilis*, with glaucous leaves brightened by yellow lines along the midrib.

PANDANUS CANDELEBRUM¹ VARIEGATUS.—In a sandy soil with abundant water this plant is very ornamental if in an isolated position, where its gracefully disposed leaves may be seen to advantage. Its leaves are 3 to 5 feet by 4 inches at the broadest part, gradually decreasing to a fine point, deeply channelled, and with marginal and dorsal spines.

PANDANUS GRAMINIFOLIUS² (from Tenasserim) is a bush 15 inches by $\frac{1}{2}$ inch, with numerous small spines on the margin of the leaf.

PANDANUS LÆVIS.³—A very dwarf species, entirely spineless or with a few very faintly developed spines on the upper inch of the leaf. The leaves are 15 inches by 1 inch, and “tending to be three-nerved,” more blunt-pointed than the others, and of a bright deep green. It is very suitable for table decoration, because if a side branch is taken off and potted, it makes a graceful ornament.

PANDANUS LAIS.—A very fine Java species of slow growth, having leaves 5 feet by 4 inches of a pale green with dark ceramic markings, with spines near the base pointing backwards and those near the apex pointing forwards.

PANDANUS MICROCARPUS⁴ (from Mauritius).—A small species, having red spines on the margin of the leaf.

PANDANUS SANDERII is a large form like *P. furcatus*, with white variation, longitudinally, near the centre.

¹ *Candelebrum*, a candle stand.

² *Graminifolius*, grass-leaved.

³ *Lævis*, smooth.

⁴ *Microcarpus*, small-fruited.

PANDANUS STENOPHYLLUS,¹ from Java.

PANDANUS UTILIS² has leaves 3 to 4 feet in length, upright or gracefully recurved, margins and dorsum thickly armed with small deep red spines.

CYCLANTHACEA.

A small family having the aspect of palms, but without an upright stem. The same treatment as palms suits the plants.

CARLUDOVICA³ GARDNERI.

CARLUDOVICA HUMILIS is 3 to 4 feet in height, and has broadly ovate leaves with prominent ribs, which terminate halfway to the margin.

CARLUDOVICA PALMATA⁴—*Panama Palm*.—Much resembles a fan palm with the leaves rising from the roots. If treated as given under "Palmaceæ" it thrives well, and proves highly ornamental. Panama hats are made from the leaves of this plant. It is an excellent plant to grow for cutting purposes, the leaves being cut and the stalk inserted in a pot of stiff clay, makes an excellent decorative plant.

CARLUDOVICA PLUMERII (from West Indies) is 8 feet in height, and has palm-like leaves divided into two.

AROIDEÆ, *The Arum or Aloo Family*,

Is easily identified by the *Caladium* and *Alu, Kuchu*, so common in gardens. The group is adapted for one distinct season of rapid growth and a season of more or less complete rest. For all this group a soil very rich in decayed vegetable matter is necessary, therefore two

¹ *Stenophyllus*, narrow-leaved.

² *Utilis*, useful.

³ *Carludovica*, after Charles IV. of Spain, and Louise, his queen.

⁴ *Palmata*, palm-like.

parts leaf mould, one part broken bricks, and one part good loam is suitable. Many of the species are naturally marsh plants, and all need abundant supplies of water during the growing season, from May till October. Protection from high wind and slight shade is desirable for most of the species. A powerful acrid principle prevails in this family, which is dissipated by cooking, and the tubers of many species become nutritious when boiled.

ACORUS CALAMUS—*Sweet flag, Bach, Gora-bach, Safed-bach, Vadajah, Wadda*.—An aromatic root, useful in flatulence and for preserving clothes from moths. Thrives nicely with shaded border treatment and marshy soil. The underground stem, powdered, is a remedy against caterpillars.

ALOCACIA¹ are tall herbs with a thick stem bearing the marks of fallen leaves, and, toward the apex, large spreading leaves with a strong sheathing stalk attached either on or within the margin. The flowers differ from *Colocasia* chiefly in having the ovules attached to the floor of the ovary, whereas in *Colocasia* they are more numerous and attached to the walls of the ovary. As those distinctions are seldom apparent in gardens, there is much confusion in the names. This group does not go to rest completely, therefore slight watering must be continued during October to April. During the latter month, re-pot or give fresh soil and manure, and as soon as the plants have started into vigorous growth, give abundant supplies of water with liquid manure once a week. These plants thrive much better on a bank of rich soil than in pots.

ALOCASIA LOWII.—When well grown, few plants are more ornamental than this. Its leaves are cordate-sagitate, 14 to 16 inches in length, olive-green with thick white ribs and deep purple underneath. This plant is rarely seen in the condition it is capable of, as it

¹ *Alocasia*—*A.*, without, and *Colocasia*.

grows very poorly in pots compared with its luxuriance when planted out in a deep bed of rich soil in the conservatory, and watered freely.

ALOCASIA SANDERIANA.—The young leaves are glossy green, and the older have metallic blue reflection. The leaf-blade is arrow-shaped, the front portion with about three triangular lobes on each side, the basal portion with one or two smaller lobes; the thick costa and stout cross veins are white, bordered with ivory-white, the margins also being white.

ALOCASIA ESCULENTA—*Shama kilanghoo*—gave 3,146 lbs. per acre at Madras; much moisture when growing, and rich soil, are essential.

ALOCASIA PORTEI is a very large growing *Alocasia*-like plant, having deeply divided leaves. Its treatment is similar to *Alocasia*. Philippine Islands.

ALOCASIA CUPREA.—A slow growing plant with leaves 12 to 18 inches in length, of a rich bronze colour on the upper and purple on the lower side. To attain good development a moist conservatory is necessary.

AMORPHOPHALLUS TITANUM is a grand species for an islet in a pond; being a sort of *suran*, it has a large tuberous root which lies dormant in the dry season and produces a flower, then a single leaf, having an upright stalk and an umbrella-like head about 6 feet high. Rich soil and abundant water is necessary.

ANTHURIUM is a tropical American genus of *Aroids*, with hermaphrodite flowers densely arranged on a spadix which is often brilliantly coloured, nerved, and veined, increasing in size, and persistent. The leaves are leathery, large, more or less heart-shaped, suspended from a strong stalk usually curved at the apex, and often of brilliant metallic hues, relieved by prominent ribs and veins. A hot moist atmosphere and a rich loamy soil, with shade from sunshine and protection from hot wind, are the essentials. Increase is effected by portions of the creeping

stem, which produces bulbs at intervals. The varieties are very numerous.

ANTHURIUM ANDREANUM has persistent scarlet spathes, corrugated and traversed by deep sinuous veins, and the spadix white at base and greenish upward.

ANTHURIUM CHELSEIENSE has a pointed heart-shaped crimson sheath 5 by 3½ inches, and the spadix white at base and yellowish upward.

ANTHURIUM INTERMEDIUM.—"The leaf-blades are deflexed, over 1 foot long, oblong-ovate, cordate at the base, with an open rounded sinus, the upper surface of a velvety green, with a slight olive tinge, the costa and principal veins being whitish. The spathe is lanceolate and of a pale reddish hue with a rosy-red spadix."

ANTHURIUM LIEVENSII has a reddish tinted spathe and a bright red spadix.

ANTHURIUM SPLENDIDUM has the leaf surface rough and blistered and the nerves velvety green.

ANTHURIUM VEITCHII (from Colombo) is climbing, and has lance-shaped leaves 3 feet in length, swollen between the veins, and red while young.

AGLAONEMA COMMUTATUM.—A dwarf plant having elliptic, pointed, entire, leathery leaves of a bright green, marked with irregular paler lines on the ribs. It thrives with moist conservatory treatment in pots with fibrous rich soil. This plant is suited for the decoration of apartments, because a branch may be cut and placed in a vase with water, where, by frequently changing the water, the plant may be kept fresh a long time.

AGLAONEMA PICTUM may be treated like the above.

CALADIUM.—Has many varieties, effective garden plants. The tubers start into growth in May, and at this time should be re-potted with a compost of river-bank soil, old cow-dung, leaf-mould, and sharp sand or coarse charcoal dust, in equal parts. At first give one thorough watering to settle the soil, afterwards water very slightly

until the leaves have made some growth, then gradually increase the supply, giving liquid manure once a week as soon as the pot is full of roots. By October, if the leaves are turning yellow, gradually reduce the supply until the foliage has quite dried up, then lay the pot away in a shady place, cover with straw, and keep dry till May next.

CALADIUM HUMBOLTHII (formerly *C. argyrites*), small leaf, with white veins.

CALADIUM RUBESCENS (from Brazil) has a leaf of rubescent colour with the petiole attached to its margin.

COLOCASIA are tuberous perennial herbs, cultivated for foliage, esculent when cooked, for tuberous roots and for ornamental foliage.

COLOCASIA AFFINIS.—A species attaining 6 to 8 inches, having peltate, cordate ovate, acuminate leaves and a green ground colour marked with large wedge-shaped blotches of dark brown between bright green veins; a very fine, free-growing, dwarf *Arad*.

COLOCASIA MARCHALII, much resembles the above in size and habit, but is distinguished by a broad central silvery band.

DIEFFENBACHIA¹ **SEGUINE**—*the Dumb Cane*.—A plant of Tropical America, has erect stems bearing at the top large parti-coloured leaves gracefully disposed on short, sheathing stalks; the flowers are monœcious and inconspicuous. The name, Dumb Cane, refers to the fact that if the stem be chewed, the tongue swells greatly. The cultivation is similar to that detailed for *Anthurium*, and the varieties are numerous.

MONSTERA DELICIOSA is a climber, bearing leaves about 3 feet by 2 feet, deeply, divided and occasionally perforated. It is adapted for a continually moist atmosphere, without hot wind, and if cuttings be planted at

¹ *Dieffenbachia*, from the name of Dr. Dieffenbach.

the base of a tree with a specially rich open soil, it will climb up slowly and bear its flower shoot, a thick cylindrical spadix, bearing naked bisexual flowers and enclosed in a large boat-shaped pale yellow spathe.

NEPHTHYTIS PICTURATA.—The plant is stemless, with terete green petioles growing about a foot high, and broadly ovate-hastate leaves, abruptly pointed at the apex; the colour is bright green with silvery-white variegation between the nerves.

PHILODENDRON¹ is a genus of Tropical American plants, chiefly climbers, adhering to trees or walls by roots, and usually with handsome leaves having brilliant metallic lustre. On the northern face of a house, with a rich loose soil and regular watering, several species grow well and are highly decorative.

PHILODENDRON NOBILE.—It has obvate-lanceolate leaves of leathery texture. The lower portion of the spathe being of a deep rosy-crimson colour, both inside and out; the upper part white internally, marked with deep rose stellate spots.

PHILODENDRON CARDERI.—Has leaves dark shaded bottle-green, with a satiny lustre, the principal ribs marked out by green lines of a glaucous or metallic hue; and at the back the leaves are of a shaded wine-colour.

PISTIA STRATOITES—*Water Lettuce, Kumbika, Nerubudeki, Takka-panna.*—A floating plant, resembling a lettuce, bearing minute, white spathed flowers in the leaf axils. It grows freely on stagnant water.

POTHOS CELATOCAULIS (of Borneo) is a fine plant for the back of a house in a hot moist region; it has 3-inch cordate leaves close together.

REMUSATIA VIVIPARA²—*Rukal, Maravari-chembo.*—A showy aroid, producing one or two large, heart-

¹ *Philodendron*, an allusion to the habit of clinging to trees.

² *Remusatia*, in honour of Abel Remusat, a celebrated physician. *Vivipara*, bringing for living young = buds in place of seeds.

shaped, pointed, bronzy leaves, having a stalk inserted within the margin. Grows on trees on the Western Ghats and other moist districts. The roots may be collected during May, while with the large, yellowish-white, reflexed spathe, and planted with leaf-mould and moss in suspended baskets. Moist air, shade, and water during the *rainy season* are necessary. Propagate by bulbils.

RHAPHIDIOPHORA AUREA.—When adhering to the stem of a tree in moist districts or growing up a post in a conservatory in dry districts few plants are more showy than this one. Its alternate leaves attain 15 by 10 inches, are cordate, ovate, acute, thick, leathery, and are irregularly marked by bands and blotches of yellow, varying in intensity from cream to orange.

RHAPHIDIOPHORA PICTUS is a creeper adhering to walls by roots and bearing leaves, while young ovate, with silvery smooth surface, but ultimately becoming pinnatifid.

RICHARDIA ÆTHOPICA¹—*Nile Lily*—A marsh plant having large, oblong, cordate, radical leaves and large pure white spathes enclosing the spadix, bearing minute flowers. In shallow water it grows freely, and may be propagated by division. Like many other water plants, it bears a range, but prefers a cool climate.

SAUROMATUM GUTTATUM—*Nurki*.—A handsome aroid, abundant on the Western Ghats and other moist districts during April and May, producing little above ground level, having a flower shoot spathe 18 inches in length, spotted with brown on a pale ground, and having a very disagreeable odour during the first few hours after opening. The solitary leaf which appears after the flower has a stalk from the root supporting a blade with about 7 to 13 oblong divisions, the central being the largest. The root is sold by *vaid*s under the

¹ *Richardia*, in honour of L. C. Richard, a French botanist. *Æthopica*, from Africa.

name *Nurki-acha-kanda*, with mythical powers, and has recently been much exported to temperate climates, where it is sold under fanciful names, and blossoms without the aid of soil or more water than the air of a moist climate affords.

*SCHISMATOGLOTTIS DECORA*¹ (from Borneo).—A dwarf perennial, with very short stems and ovate acuminate leaves, the upper surface of which is green, decorated with thickly distributed, oblong, silvery-grey blotches, covering fully half the area, the under side being pale green.

SYNGONIUM WENDLANDII.—A climbing aroid, adhering to walls by its roots and bearing trifoliate leaves, each leaflet 6 inches in length, lance-shaped, and of a soft deep green. Its white spathed flowers are produced freely from the upper axils if the climber be planted in a loose, rich soil in moist shade.

THE SURAN—*Amorphophallus virosus*—*Kanda, Wa, Shina, Suran*.—In districts with heavy rainfall, where there is difficulty in keeping the garden tidy during the monsoon season, this plant may be used with grand effect. A position sheltered from strong wind and a very highly manured soil is desirable. A piece weighing about one pound, cut from the centre of the large root, may be planted, six inches deep, in May, then, on the advent of the monsoon, the great stem, bearing its umbrella-like leaf, will appear, and remain ornamental during the rainy season.

TYPHONIUM TRILOBATUM (formerly *Orixense*)—*Ghekul, Surie-kundu*.—An aroid with radical deeply three-lobed leaves; the lobes ovate, pointed, 8 to 10 ins. long and the same in breadth, and having a double nerve parallel with the margin. The spathe has a short stalk, is large, red inside, green outside, and the spadix has a long, red, tapering appendage. In moist districts, it is

¹ *Schismatoglottis*, a deciduous tongue, from the falling-off, tongue-like, part of the spadix. *Decora*, decorative.

cultivated for its tubers, which are the size of a pullet's egg and acrid when fresh. It gave 3,206 lbs. per acre in a Madras experiment.

XANTHOSOMA VIOLACEUM¹—A strong-growing Alocasia-like plant of a deep purple colour, paler beneath. It needs rich soil, abundant water, and slight shade.

XANTHOSOMA LINDENI² resembles the above, but is distinguished by a pale purple hue set off by the midrib, large veins, and often large patches of the leaf being of an ivory-white colour. Its culture resembles the above.

XANTHOSOMA HYPOPHYLLUM is easily distinguished by a remarkable small leaf attached to the midrib on the lower side, near to the apex of the normal leaf.

ZAMIOCULCAS LODDIGESII has radical erect pinnate leaves, with six to eight pairs of alternate and deciduous pinnæ. It is of easy culture with moist shade.

LEMNACEÆ, *The Duckweed Family.*

Includes *Lemna*, small plants having one or two oval floating leaves with one or more pendulous roots, and *Wolffia arriza*, globular green rootless plants about the size of grains of sand, and said to be the smallest of flowering plants. Those plants are apt to become too abundant, and need the use of a sieve.

NIADACEÆ.

Submerged plants of great beauty and easy culture in sweet water; they generally propagate by tubers and specialised horny buds which fall to the bottom and reproduce the species if mud be available.

OVIRANDRA FENESTRALIS—the *Lattice Leaf* or *Water Yam* of Madagascar—is an interesting plant, from the leaves forming a network owing to the cellular tissue

¹ *Xanthomosa*, an allusion to the yellow stigma. *Violacea*, violet coloured.

² *Lindenii*, Linden's, after the well-known plant merchant.

being greatly reduced. In gently moving clear water it makes itself at home, but when grown in a glass globe its remarkable formation is more easily seen. It is propagated by tubers and specialised buds.

POTAMOGETON CRISPUM.—An elegant water plant with alternate, sessile, lance-shaped leaves, crisped at the edge. Propagated from specialised horny buds.

CYPERACEÆ, *The Sedge Family.*

Plants closely allied to the grasses, but distinguished by the edges of the leaf-sheaths being joined round the stem instead of open, as in grasses, and usually angular stems.

CYPERUS ALTERNIFOLIUS.—An elegant sedge, much cultivated in gardens, and is of interest because it has not been found growing truly wild and its native country is doubtful. It thrives especially in the shallow water near the margin of a pond. A white variety of great beauty was very abundant in Bombay many years ago, and may be recovered with advantage.

CYPERUS ESCULENTUS—*Tiger Nut*, of shops—resembles a weed, *C. rotundus* (*Nagar-motha*, *Motha*, *Shuga-tunga*), but the roots of the esculent sedge have a fine filbert-like flavour, while those of *Nagar-motha* have a strong perfume and are used with fragrant gums in the manufacture of *ud bati*, a composition which gives a pleasant perfume when burned, *C. esculentus* is easily managed from roots, and makes an excellent plant about 1 foot high.

CYPERUS PAPYRUS—formerly *P. antiquorum*.—A plant of great interest as one of the early forms of paper. As described by Pliny, the paper was made from strips of the pith laid side by side and other strips laid transversely, and the whole pressed together. The mop of leaves at the end of the long stem was said by Pliny to be of no use except to adorn the statues of the gods. It is one of

the components of the *Sudd* which blocks portions of the Nile, and is a very graceful ornament when planted on the margin of a pond. It thrives nicely in northern gardens, and also grows well in the south, but is subject to the attacks of an insect which destroys the whole plant. Spraying with a kerosene emulsion would, no doubt, remedy the defect; but use for the insect might be found on the Nile.

CYPERUS TEGETIFORNIS—*Madur kati*—from which “China” matting is made, abounds at Kalyan; and, as it grows well in brackish water, it might be cultivated with profit.

HYPOLYTRUM LATIFOLIUM—*Tunga*—is an elegant plant for the edge of a pond, having leaves 1 inch broad and 3 feet long, and small brownish flowers in dense panicles.

SCIRPUS GROSSUS—*Kysur*.—A sedge growing on the margin of ponds, and producing elegant foliage and edible nuts $\frac{1}{2}$ inch in diameter, fibrous outside, globular, and of fine flavour. Moist parts of India and Ceylon.

SCIRPUS KYSOR—*Kesur*, *Kesuri*.—An ornamental sedge, attaining 3 feet in height on the margin of a pond, and bearing edible tubers dark brown outside and covered with short fibres, but inside white and of a pleasant, nutty flavour. It is easily grown from fresh tubers, which are procurable in the markets in moist districts.

GRAMINEÆ, *The Grass Family*,

Has been characterised as the most useful of all the families of plants to man, because life could be sustained on the products of this family only; in garden arrangements there are few objects more graceful than clumps of bambu on the banks of tanks. The young branches make an elegant combination with lilies in house decoration, and the flowering branches of many grasses are graceful and durable ornaments. Any ordinary rich

garden soil with abundant water and good drainage will grow garden grasses. Propagated by dividing the root-stock, by layerings, cuttings, and seeds. The seed bed for grasses should be pressed firm. Lawn manure:—Basic slag, 14 lbs.; kainit, 9 lbs., and *applied later*; nitrate of soda, 5 lbs. for 100 square yards.

AGROSTIS NEBULOSA.

ANDROPOGON SCANDENS¹—*Marwail*—is a useful grass for lawns and paddocks; on a deep alluvial soil, if regularly grazed over, it forms a smooth green turf and yields very abundant forage, attaining 6 tons per acre of green fodder from the first cutting and about 4 tons from the second cutting. It is propagated by dividing clumps and planting at the beginning of the rainy season.

ARUNDO DONAX VARIEGATA is a very handsome grass, growing 10 feet in height, with a stem about 1 inch in thickness, the leaves about 15 inches long by 1½ inches broad at the base and tapering to a point, and brightly striped with white. Its natural position is the bank of a river, but in such a place it becomes green very soon. In a comparatively dry and poor soil it keeps richly variegated.

ARUNDINELLA FALCATA (from Himalaya).—A bambu about 8 feet high and ½ inch in diameter at the base. Grows well in gardens from 2,000 feet altitude upward, and is propagated by dividing the stems.

ARUNDINELLA FALCONERI, a bambu very like the above; bears flowers once.

BAMBUSA—*Bambu*.—The large bambus are very graceful plants and form a grand screen on the windward side of the garden, but must be kept at a distance of about 50 feet from the garden proper, because they are surface feeders and the roots extend greatly and im-

¹ *Andropogon*, from *aner*, a man, and *pogon*, a beard; tufts of hair on flowers. *Scandens*, climbing.

poverish rich soil. Any good soil with a free supply of water is suitable. For propagation, seed is the most convenient when it can be obtained fresh, but, as many species of bambu flower at long intervals, seed is not often procurable; in that case, it is necessary to cut down a clump about 3 feet from the ground, dig out the stumps, and plant separately.

BAMBUSA AUREA VARIEGATA.—The stems of this species are richly ornamented with bright golden stripes, which break joint at every node and form a most interesting combination of golden stripes, ever varying in breadth, and dark polished green stems. It is propagated by tying soil round a stem and watering frequently, then, when roots have appeared, the new plant may be cut off below the soil.

BAMBUSA FORTUNEI VARIEGATA.—A graceful conservatory plant about 1 foot in height.

BAMBUSA NANA.—A very pretty bambu, attaining 10 feet in height by $\frac{1}{2}$ inch at the thickest part. It is easy to propagate by dividing the stems during the rainy season, and forms an excellent fence in wet districts.

BRIZA MAXIMA—*the Quaking grass*.—An ornamental grass having large flower spikelets pendulous by a hair stalk. Sow when the monsoon is nearly over.

BROMUS BRIZÆFORMIS.

DENDROCALAMUS STRICTUS (of India and Japan).

ERAGROSTIS ELEGANS has small spikelets, and is an elegant addition to flower bouquets. Sow during monsoon and make seed-bed firm.

LAMARCKIA AUREA.

LAWN GRASS.—The most suitable grass for lawns is *Cynodon dactylon*—*Dog's-tooth*, *Hariali*, *Durwa*, *Neguil* (of Egypt)—a plant which is found on sea-coasts from the South of England to Australia. *Hariali* is a true sea-shore plant, and thrives on a good soil. A fine sandy loam produces short close growth, suitable for a lawn.



DENDROCALAMUS GIGANTEUS

For propagation, the underground stems (roots) may be chopped up and mixed with a plaster of dung and earth, then spread on a smooth surface, covered with $\frac{1}{2}$ inch of sandy soil, and rolled. If the season is near the end of the rains, the first growth which takes place will have flowers, and these being allowed to ripen seed, it may be cut and dried and the seed separated. Otherwise it is difficult to obtain seed in quantity. The Bombay *Hariali* is a very different plant, which has the same habit of growth (see *Paspalum distichum*), with a much finer green, but is unable to bear the rolling necessary for a lawn.

MAIZE—*Zea mays*, *Mukka*.—Grows freely in rich, moist soil during all the warm part of the year; but to yield well, it requires to blossom during dry weather, as heavy rain may wash away the pollen. The ornamental striped variety may be sown during June to March.

MELOCANNA BAMBUSOIDES (of India) is a bambu with smooth stems $1\frac{1}{2}$ inch thick and leaves $1\frac{1}{4}$ by 6 to 8 inches.

MISCHANTHUS JAPONICA—*Eulalia*.—The variegated forms of this grass are highly ornamental, and suited for the tropical conservatory, or for open air culture with protection from noontday sun, from 3,000 to 7,000 feet altitude. They are slender grasses, attaining 3 to 4 feet in height. The form *siriata* has white vertical stripes, and *zebrina* has transverse cream-coloured stripes.

PAMPAS GRASS—*Cortadenia argentea*.—Thrives at Simla and other hill stations with moderate rainfall and in the Agri.-Horti. Society Gardens at Madras, and may be propagated by division of the clump and by seed. A similar effect may generally be produced by planting *Saccharum sara*.

PANICUM ALTISSIMUM¹—*Guinea grass*.—A very useful fodder grass, specially suitable for a sandy soil under

¹ *Panicum*, the old Latin name used by Pliny, from *paniculum*, a panicle, alluding to the usual form of the inflorescence. *Altissimum*, very tall.

irrigation, and well adapted to occupy vacant spots in compounds or on the sides of irrigation channels. It grows freely during the season, yielding green fodder during that period of scarcity. This grass is better adapted for horned cattle and mules than for horses.

PASPALUM DISTICHUM, which grows at the seashore at Bombay in company with *Hariali*, has been called *Bombay-acha Hariali*. It resembles true *Hariali*, but has a much brighter green, and only two short, stout, extending spikes in its inflorescence, whereas *Hariali* has from two to five slender ascending spikes. When *Paspalum* is planted in a lawn, it looks very fine for about a year, but the hardy Dog's-tooth grass supplants it completely.

POA VARIEGATA is a cool-climate grass of dwarf habit, very graceful in the conservatory at high altitudes.

POGONATHERUM SACCHAROIDEUM—*Bambu grass*.—A very ornamental grass, having slender culms attaining 2 feet in height, bearing divergent leaves about 4 inches long. It resembles a miniature bambu, and is of graceful effect.

POLYTOCA COOKEI is a grass discovered by Dr. Cooke, C.I.E., near Mahableshtar; but his specimens, although fragmentary, were sufficient to show the grass was unknown, and search in the locality disclosed a maize-like local plant occupying a narrow band at nearly 4,000 feet altitude. In gardens at 2,000 feet altitude, it grows nicely from seed, and shows the separation of the male from the female flowers, which is common in that group.

SACCHARUM SPONTANUM—*Kahn, Kansa, Dirip*.—For the banks of a tank or stream few grasses are more ornamental than this. If the lower part of the stem is planted, it roots freely, and needs little more attention.

SACCHARUM PROCERUM—*Yera or Weda ouse, Teng*.—A very tall, graceful grass, resembling a large variety of sugar-cane, but as it does not yield sugar, it is called the *Madman's Sugar-cane*. It is excellent for a fence on



POLYTOCHA (COOKEI).

irrigated land, as large stakes thrust into the ground take root quickly. It is most convenient for staking young fruit trees, as several rods fixed in the ground round the tree may be brought together and tied at the top, thus providing both shade and support against storms.

SACCHARUM SARA—*Sarkara, Panni, Shur, Kanwar*; and SACCHARUM CILIARE, *Saccharum munja, Jhar Pulwar, Patawar*—are tall grasses which form excellent game coverts in Guzerat, the large plants standing a short distance apart and permitting free passage with shelter. Solitary plants on a lawn have the grand effect of Pampas grass in England, and are very easily propagated by chopping out a portion of a clump.

SUGAR-CANE—*Ouse, Ganda, Ik, Uk, Ak, Punda, Saccharum officinarum*.—Although the production of sugar-cane is not usually a garden operation, the way to improvement of the cane crops lies through hand fertilisation of the flowers and the selection of varieties by means of the polariscope, which is used to determine the proportion of sugar in specimens; it is noticed here. Sugar-cane very rarely produces seed, but as it bears flowers frequently in Western India and the North-Western Provinces, seed may be obtained by watching the flowers, and when the feathery stigmas are protruded, shaking another more advanced spike of flowers over the one selected as the female parent. The stigmas are not conspicuous, owing to the abundance of long silky hairs about the flowers, but patient search discloses them, and by the treatment of a number of spikes in different stages of progress, the fertilisation of some may be secured. Careful labelling and staking is necessary to distinguish and protect the treated flowers. In the West India Islands much progress has been attained with sugar-cane by this process.

THYSANOLÆNA AGROSTIS—*Bouquet grass*.—A grass about 8 feet in height, with leaves 1 foot long by 3 inches broad, and producing a large and very graceful panicle of minute flowers, the outer glumes fringed with slender



THYSANOL ENA AGROSTIS.

hairs. For the centre of a group of dwarf shrubs, this is a very fine ornamental grass, and the inflorescence makes an excellent broom, like that of the Broom-corn of America; a form of *Iowari* or *Cholam*.

TRICHOLOENA ROSEA, native of the Cape; if sown in November, very soon becomes an elegant plant about 2 feet in height.

FILICES, *The Fern Family*.

Although ferns generally thrive with a still, moist atmosphere and shade, there are many exceptions, and the conditions they elect to live under are almost as varied as their graceful forms. The special requirements of certain species will be noted separately, but a friable soil, enriched with leaf-mould and kept open by crushed brick, sand, or charcoal in coarse powder, and thoroughly drained so that water may pass freely through the soil and prevent the accumulation of organic acids, is generally suitable.

Ferns increase by several methods, but especially by *spores*, minute seed-like bodies, developed in spore-cases which are clustered in many fashions on the lower face of the fronds or fern leaves and disseminated by physical agencies. Having reached a moist surface, the spore germinates, produces a prothallus, or little leaf, bearing on its face organs analogous to the stamens and pistil of a flower, termed antheridia and archigonia. The antheridia produce pollen grains differing from those of a flower by their motion through water by means of protoplasmic cilia, and termed sperm cells or spermatozoids. The archigonium develops a germinative cell, which, being fertilized by absorbing a sperm cell, produces a bud, the beginning of a new fern plant. Many ferns also increase asexually by special buds, which arise from the fronds by division of the plant or from runner stems, and, coming in contact with the soil, form new plants; and one of the most interesting positions is to find them freely

developed from the lower portion of the dried-up stalk of a fern leaf, as occurs in *Scolopendron cristatum*.

Ferns are very widely distributed; therefore, to save space, their home countries have been left out.

That there is a special soil for ferns, is a great mistake. They are usually grown in Britain in fibrous peat, but that is only as a matter of convenience; any convenient good soil (proved by producing well the common crops of the country), and made thoroughly friable and well-drained by a liberal addition of charcoal broken small, or of crushed bricks and some decayed leaves, so that the soil may bear the frequent watering necessary yet not become sour, will suit.

TO RAISE FERNS AND SELAGINELLAS FROM SEED (SPORES).

Prepare a compost of two parts fine loam, one part leaf-mould, and one sand, and sift through a half-inch sieve; then take a pot not less than 6 inches in depth, arrange potsherds carefully to a depth of 2 inches, pack in 2 inches of soil firmly, leaving 2 inches vacant at the top. Give a good watering on the top from a fine rose watering-pot, taking care not to disturb the soil or cause it to run to one side. When the water has passed through, mix the spores with about 100 times as much fine soil and sow thinly. Cover the mouth of the pot with a pane of glass and place the pot in a saucer containing 1 inch of water. The whole must then be kept in a close frame, and as soon as the young plants are fit to handle, lift with the aid of a pen, pot singly in small pots, and replace in the close frame.

TREE FERN.—Elegant tree ferns grow in Nilgiri and Sikkim, and may be brought from those districts during the cold season with safety. The fronds and roots may be cut off, and the stem packed with moss in a box. A twenty days' journey in this condition appears not to harm them. When the stems are received in the conservatory, a bed of broken bricks and potsherds should

be arranged to provide perfect drainage, the stem placed on the drainage, and carefully packed round with a mixture of four parts potsherds or broken bricks, one part good loam, and one part leaf-mould made very firm. The stem should be covered with moss and kept moist by frequent watering. When growth is fully established, the soil may be enriched by a surface layer of 4 inches of leaf-mould and turfy loam.

ACTINOPTERIS RADIATA—*Mayaruka* and *Morphanki*, or *Peacock's Wing*—is a very interesting fern, 2 to 6 inches high, found widely in India and Africa, and especially on the northern side of the city walls at Bijapur. During the rainy season the plant resembles a miniature fan-palm; during the dry season it contracts greatly, and may be sent by post safely. The plant is used in medicine as a styptic and anthelmintic.

ADIANTUM CAPILLUS-VENERIS—*Maiden Hair fern*, *Razouse*, *Kuwatrei*.—Is abundant throughout the Decan, growing on the vertical face of marl beds which have been exposed by the action of a stream and have water trickling through the soil. The marl is an intimate mixture of clay and lime, and the Maiden Hair shows a decided preference for such a soil.

ACHROSTICHUM AUREUM.—This grand fern grows naturally on banks in the tidal creeks, near Kumta, which are often flooded to a considerable depth.

ACHROSTICHUM SCANDENS.—A grand climbing fern, with pinnate leaves, growing naturally in Assam Valley.

ALSOPHILA GLABRA.—A handsome tree fern, commonly with a stem attaining 6 feet in height and 9 inches in circumference, bearing a magnificent crown of bipinnate fronds, easily distinguished by the lines of fruit (*sori*) being arranged like the letter V inverted. It grows in the dense forests of N. Kanara, where the rainfall is heavy and the atmosphere always moist.

ALSOPHILA SPINULOSA—*Pugjik* (of the Lepchas).—An elegant tree fern, growing at 2,000 feet altitude at Sikkim.

BLECHNUM ORIENTALE.—Develops with age a short stem bearing on its summit the erect or gracefully receding fronds attaining $3\frac{1}{2}$ feet in length by 8 inches in breadth. The fronds are pinnate, and the segments bear continuous lines of fruit (*sori*) on each side of the midrib. It is at home in the moist forests of N. Kanara, and on the sloping banks by the roadside may be seen in great magnificence. The rainfall of that country is from the beginning of May to the end of October, but the air is moist and the forest evergreen. In company with it grow *Alsophylla glabra*, *Pteris pellucida*, *Angiopteris evecta*, and *Stenoloma chinensis*, while near by, in the full sun, may be seen *Gleichenia dichotoma*.

CERATOPTERIS THALICTROIDES—*Jungli-Jhow*.—An annual fern, having the barren fronds pinnate, with pinatifid leaflets and super-decompound fertile fronds. It grows in shallow water, with mud, from sea-level to a considerable altitude.

DIDYMOCHLÆNA LUNULATA (of the Tropics widely), is a free-growing bipinnate fern, about 3 feet high.

GLEICHENIA DICHOTOMA has dense upright growth and two-branched fronds. It thrives in moist climates from 2,000 to 6,000 feet altitude, and endures sunshine.

GYMNOPTERIS QUERCIFOLIA (of Concan)—*Basing, Kadi-pan*.—A large fern which grows on trees near the sea.

NEPHROLEPSIS.—The species of this genus are indispensable in gardens and easily recognisable by the long simply-pinnate fronds with deciduous pinnæ and the slender root-like runners that are produced in abundance; commonly grown in suspended baskets; the species grow better when planted at the top of a cliff and are permitted to range on its face. *N. CORDIFOLIA* is grown with fine effect on a cliff face in a public garden in Bombay, and all the species need only thin, if any, shading, provided the air be moist. For baskets or cliff planting, porous water-pots, with covers to prevent mosquitos, save

much labour in watering; and *N. RUFESCENS* TRIPIN-NATIFIDA is a remarkably graceful fern with upright fronds receding at the apex. It thrives in a conservatory at Poona.

OLEANDRA ARTICULATA.—A climbing fern, having entire lanceolate leaves about 8 inches in length and *sori* near the midrib. A fine plant for the conservatory at 2,000 feet altitude.

OSMUNDA REGALIS—*the Royal fern*—is found in Nilgheri at high altitudes, and near sea-level on the banks of a stream near Kumpta, in N. Kanara, as well as Japan, Morocco, and Britain, and may be cultivated in moist climates with shade and flowing water.

PLATYCERIUM ALCICORNE—*the Staghorn fern*.—Thrives on trees at Colombo, where the air is moist, rain frequent, and the temperature high without hot wind.

WOODWARDIA RADICANS.—Has very long pinnate fronds which curve over and root at the points. It is a grand plant for a suspended basket, and during the growing season may have a porous water pot in the centre. It is widely distributed, and grows near streams in Himalaya at 5,000 feet altitude.

FURTHER SELECT FERNS.

<i>ACHROSTICHUM</i> VARIABLE.	<i>A. GHIESBREGHTII.</i>
<i>A. VIRENS.</i>	<i>A. GRACILLIMUM.</i>
<i>ADIANTUM</i> BAUSII.	<i>A. LATHOMII.</i>
<i>A. CARDIOCHLENA.</i>	<i>A. CUMULATUM.</i>
<i>A. CAUDATUM.</i>	<i>A. LUNULATUM (Kull-kha).</i>
<i>A. CONCINNUM.</i>	<i>A. MACROPHYLLUM.</i>
<i>A. CUNEATUM.</i>	<i>A. MOOREII.</i>
<i>A. CURVIFOLIUM.</i>	<i>A. PEDATUM.</i>
<i>A. DOLABRIFORMIS.</i>	<i>A. PERUVIANUM.</i>
<i>A. EDGEWORTHII.</i>	<i>A. TRAPEZIFORME.</i>
<i>A. FARLEYENSE.</i>	<i>A. WILLIAMSHII.</i>

- A. VENUSTUM (*Hansraj moh-barka*).
 ALSOPHILA CRINITA.
 A. C. GIGANTEA.
 A. ALBA SETACEA.
 ASPIDUM FALCATUM.
 ASPLENUM DIMORPHUM.
 A. ERECTUM.
 ASPLENIUM ESCULENTUM.
 A. FELIX FÆMINA.
 A. FALCATUM.
 A. LONGISSIMUM.
 A. RADIATA (*Actinopteris*).
 A. SHEPHERDII.
 A. TENERUM.
 BLECHNUM BRAZILIENSE.
 B. ORIENTALE.
 CHEILANTHES FARINOSA.
 C. TENUIFOLIA.
 CONIGRAMMA JAVANICA.
 CYATHEA DR. EGEL.
 DAVALLIA FIJIENSIS.
 D. IMMERSA.
 D. POLYPODIOIDES.
 D. TENUIFOLIA.
 DICKSONIA ANTARTICA.
 D. CULCITA.
 D. SQUARROSA.
 GYMNOGRAMME CALOMELANOS.
 G. CHRYSOPHYLLA.
 G. DECOMPOSITA.
 G. MERTENSII.
 G. SCHIZOPHYLLA SUPERBA.
 G. PULCHELLA WETENHALLIANA.
 GYMNOPTERIS QUERCIFOLIA.
 HEMIONITES CORDATA (*Chaculy*).
 HEMITELIA DECIPIENS.
 LASTREA BEDDOMII.
 L. COCHLEATA.
 L. DIPARIOIDES.
 LINDSAYA CULTRATA.
 LYGODIUM SCANDENS.
 MICROLEPIA POLYPODIOIDES.
 NEPHRODIUM MOLLE.
 N. SETIGERUM.
 N. MACROPHYLLUM.
 NEPHROLEPIS BAUSII.
 N. CORDIFOLIA.
 N. PECTINATA.
 N. TUBEROSA.
 N. DAVALLIOIDES.
 N. DUFFII.
 N. ENSIFOLIA.
 N. EXALTATA.
 N. INFERANS.
 ONYCIUM MULTISECTUM.
 PÆCHLOPTERIS FLAGELLIFERA.
 POLYPODUM PROLIFERUM.
 POLYSTICHUM ANGULARE.
 P. AURICULATUM.
 P. CRASSIFOLIUM.
 PTERIS BIAURITA.
 P. CRETICA ALBA LINEATA.
 P. ENSIFORMIS.
 PTERIS PELLUCIDA.
 P. QUADRIAURITA.
 P. SCABERULA.
 P. SEMIPINNATA.
 P. SERRULATA.
 P. TENUIFOLIA.
 P. TREMULA.
 STENOLOMA CHINENSE.
 THAMNOPTERIS NIDUS.

SELAGINELLA.—Although different from ferns, thrive under similar treatment. The plants branch freely, and bear small sessile leaves of two forms arranged in four ranks, and are often coloured in brilliant metallic blue shades. Of easy propagation by cuttings, but it is interesting to raise plants from spores, which are produced during the cold season in four-ranked spiklets terminating branches, and of two sexes, the male numerous, orange-coloured, minute, and terminal; the female, basal, white, few, and comparatively large. The male and the female spores may be sown together on the surface of a mixture of leaf mould and sand in a pot, and covered with a sheet of glass and watered by immersing the pot nearly to the brim.

S. CAULESCENS.

S. SERPENS.

S. CUSPIDATA.

S. MUTABILIS.

S. GALEOTTII.

S. UNCINATA.

S. INEQUALIFOLIA.

S. VITICULOSA.

S. LEPIDOPHYLLA.

S. WILDENOVII.

S. KRAUSSIANA.

SALVINIACEÆ, *Water Ferns*,

Are fugacious floating ferns having a male and a female prothallus.

SALVINIA CANDATA and **S. NATANS** are common in the ponds of Calcutta Botanic Gardens.

AZOLLA PINNATA (of Australia) occurs widely in tanks in districts having a moist climate; it has pinnate wrinkled fronds $\frac{1}{3}$ inch in length.

MARSILACEÆ (includes **MARSILIA QUADRIFOLIA**)—*Chick-linta-kura*, *Shusnie-shak*—which is common in shallow tanks and resembles oxalis.

Mosses and liverworts, which abound on the stems of trees in moist climates, are decorative and interesting when planted near dripping water, the *Jungermannia* genus especially are worth attention where spray from

falling water is available during six months of the year. Sphagnum or bog-moss, so useful in growing orchids, occurs about 9,000 feet altitude in Sikkim and in Ceylon.

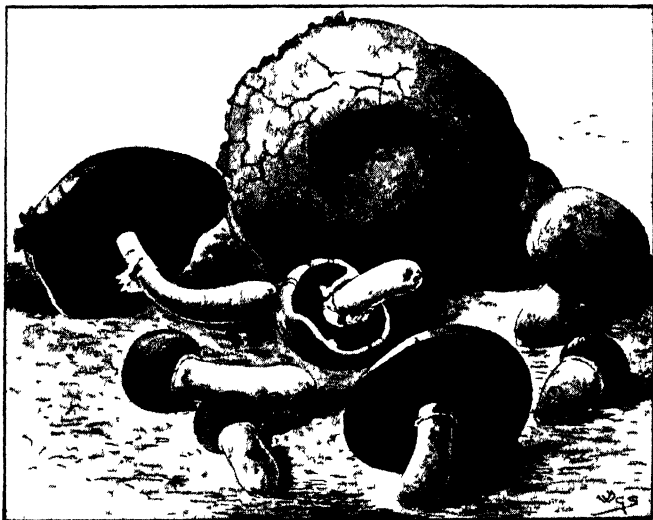
FUNGI, *The Mushroom Family*,

Are plants without green colour or any distinction as to stem and leaf, and are often seen growing on dunghills. Many are serious pests in the garden, destroying other plants and timber, and are to be combated with sulphates as detailed, page 71. Some are poisonous, but a few are delicate esculents. Members of this family increase by *spores*, very minute cells of various colours, which are carried about by wind, and differ from seeds in the absence of an embryo; the cells having alighted on a suitable soil, increase by forming a ramifying white thread-like body, which permeates soil, notably that of a well-ramp where cattle are working day after day, and their dung has been trodden into firm soil, but the leaves and stems of plants, either living or dead, as particular sorts of fungi require, are used as soil, and this hidden portion of the fungus, termed *mycelium* or spawn, may grow a considerable time without showing any development on the surface. By the combination of certain cells of the mycelium, small hard irregular shaped bodies termed *sclerotia*, or reserve bodies, are formed, and the mycelium may dry up and disappear, to be reproduced from the sclerotia at a favourable season. In due course the fructification or mushroom appears, and usually grows with great rapidity. When full grown, in this instance, it may be umbrella-shaped with a central stalk supporting a spreading cap, which bears on its lower face gill-like membranaceous radiating plates, bearing spores in great numbers. The fructification may assume different forms in various genera. In general cultivation there are several species termed Mushroom, and many varieties.

AGARICUS CAMPESTRIS—*the Common Mushroom*.—The gills are at first pink- or salmon-tinted, but deepen

to a purplish-brown; it has a characteristic fragrance, and grows in open pastures.

AGARICUS ARVENSIS—*the Horse Mushroom*—is less delicate in flavour, larger, whiter in the gills, and with a smooth white cap.



AGARICUS WOODROWII, MISSI
POONA BROWN MUSHROOM.

AGARICUS GAMBOSUS—*St. George's Mushroom*—appears in spring; it has no ring on the short, thick stalk, smells of new meal, and is greatly esteemed.

AGARICUS WOODROWII—*the Poona Brown Mushroom*.

Those first three species grow in the mountains of Northern India and adjacent countries, and have been cultivated to some extent, but the mean yearly temperature at which the plant thrives being much lower than that of southern districts, practical success cannot be expected. A fine species has been found growing wild in the Deccan, near Poona—unfortunately, too late for the



LEPIOTA ALTISSIMA, *MASSEE*
THE GIANT MUSHROOM OF KHANDAIA

writer to attempt its cultivation, but it is improbable that special difficulty will be met with, and the course indicated is noted under *Brown Mushroom of Poona*.

As a matter of practical importance in the cultivation of Mushrooms, it may be noted that orthodox Hindus detest such plants, probably because, according to Sir W. Jones, Yama has declared, those who eat mushrooms are the most despicable of deadly sinners.

THE GIANT MUSHROOM OF KHANDALA—*Lepiota altissima*, *Massee*; vern. *alim*—is a very large, pure white and wholesome fungus of the umbrella form. It attains 1 foot in height and 6 inches in width of cap, and grows in open pastures at Khandala. It is regularly eaten by the Ghât people, but its flavour is very mild.

THE BROWN MUSHROOM OF POONA—*Agaricus Woodrowii*, *Massee*; vern. *alim*.—Appears abundantly on the golf links at Yerowda, Poona, and similar open pastures, about the end of September, during a short season, varying with the rainfall. It attains about 4 inches in height, and the same in width of cap, but is often gathered, and to be preferred, before opening; it is then an oval, smooth, yellowish-brown mushroom, as large as a man's thumb, with an agreeable odour and a firm truffle-like consistence, and it keeps in good condition several days. When any one succeeds in cultivating this fungus, a distinct advance will have been secured.

One of the difficulties in the cultivation of the common Mushroom in India is the fact that the temperature at which it thrives is much lower than that of India, except in northern districts during a few months of the year. Being a native of the Deccan, this species bears a high temperature, and, if amenable to cultivation, would be an important acquisition. The following system may be tried with much prospect of success:—During the rainy season, take, of horse-dung without litter, 2 parts, and the brown stony soil common in the Deccan, 1 part by bulk, mix thoroughly, spread on the ground 6 inches deep and tread firmly. As soon as

the mushrooms appear on the golf course at Poona, clear the weeds from the prepared bed, break up full-grown mushrooms in water and sprinkle on the prepared ground, cover with straw, and water daily for a month; weeds will, of course, spring up, and should be removed by cutting near the surface, not by pulling up, as the bed should not be disturbed or trodden at this stage. If successful, the bed will become, for a time, a mass of fine white threads—"spawn," or mycelium—and as this disappears, small, hard, white tubercles of irregular shape and agreeable odour and taste—the sclerotium or resting-stage of the fungus—will appear. During the hot season, the bed should remain dry, and may be trodden without injury. The crop need not be expected before the end of the rainy season, but if the hard sclerotia have formed, numerous beds may be impregnated by pieces of the original one.

In Northern India, Mushrooms have been grown on straw piled in heaps 2 feet deep in a moist state in the shade of trees and trodden firm; this gave Mushrooms during wet weather.

WAS THE MANNA OF SCRIPTURE A MUSHROOM?

Much learned writing has been done on the identification of the Manna of Scripture. A *résumé* of the subject may be found in the *Encyclopaedia Britannica*, Ed. VIII., Vol. XIV., but no suggestion that the manna was a mushroom appears in that or any other work I have access to.

The manna appeared suddenly on the ground in the mornings in immense quantities and disappeared as the sun rose high. It was small, round, and of the colour of olibanum, a dull white. It was sweet, wholesome food, and if kept until the following day it was full of worms. The Israelites enjoyed it at first, but soon began to complain. So far the description is that of a mushroom. The size is said to have been that of a seed identified as coriander, but the vernacular name appears to be the only ground of identification, and it is well known that in many instances such names are unreliable.

RUBBER, INDIA RUBBER, AND CAOUTCHOUC.

Those three terms designate in the English language the same substance, a constituent of the *latex* or milky sap, principally from plants of the tropics. But the possession of milky sap does not always imply the presence of rubber. Many different substances are found in the *latex*, and to discover which sap contains rubber in sufficient quantity and of suitable quality, is of importance at the present time. For my own satisfaction, it was sufficient to place a few drops of the *latex* between leaves of my note book, with notes of the plant, date, weather, etc., these being kept a few days in a dry atmosphere, the water evaporated, and the rubber left behind as a clot of adhesive elastic substance.

ASSAM or BURMA RUBBER TREE—*Ficus elastica*, *Attah Bur*, *Yok* (N. O., *Urticaceae*).—Very like a banyan tree and of similar epiphytal habit. The “fig” is about the size of a pea, and falls off ripe in January. One “fig” has about seventy-five seeds, therefore an ounce is enough for any beginner to manage. The treatment found so successful with the banyan is applicable here. Bricks broken roughly are placed in a saucer with half an inch of water and a little leaf mould, the “figs” are broken up, and the seed scattered thinly on the broken bricks. The water goes up by capillarity, but is supplemented by a gentle shower from a watering-pot daily. In Mr. Mann’s experiments, three months were necessary for germination, but in my hands a much shorter time was sufficient. Moist air and shade are desirable. The young seedlings grow much faster than cuttings, and are soon ready for removal into pots with sandy soil. If sand is not available, broken bricks may serve the purpose. The Conservator of Forests, Rangoon, Burma, may be asked for seeds. Fourteen years at least, and a moist climate, are necessary to produce rubber.

AGANOSMA CARYOPHYLLATA—*Malati* (N. O., *Apocynaceae*).—A climber of the Himalaya, of many years’

growth, bearing pure white fragrant flowers. There is one growing over an arbour in the west terrace of the Government House, Ganesh Khind; and

AGANOSMA CYMOSA, of the Konkan and North Kanara, are promising subjects for enquiry. Fruit produced in Himalaya, cylindric, spreading: seeds few, large, covered with down.

CALOTROPIS GIGANTEA—*Ak. mudar*.—In a book recently published, this plant is included among rubber producers. I have tried it often, and never found any rubber. It may produce rubber at a particular season, but I never found any, although there was always plenty of milky sap. The plant is a shrub growing on the poorest soils, in the driest part of India. There are two varieties, one bearing pure white flowers, the other, more common, bearing purple flowers. Its cultivation is the same as that given for *valayeti vakundi* mentioned below, but there is no occasion for supporting trees or for irrigation even the first year. If this plant is found to yield rubber, its relative *Calotropis procera* should be tried. It grows sparsely over the wide region of its "sister," I may say, its congener, but more freely on the sides of the railway out of Kurachi towards the bridge at Sukker. If it is found to yield rubber, it will be a grand discovery.

CEARA RUBBER TREE—*Manihot Glaziovii* (N. O., *Euphorbiaceae*)—is of rapid growth and is now found in nearly every moist tropical country. It bears seed freely when five years old, and at Poona springs up from self-sown seed.

CENTRAL AMERICAN RUBBER—*Castilloa elastica* (N. O., *Urticaceae*), and also *Alstonia plumosa*, Fiji.

CHONEMORPHA MACROPHYLLA (N. O. *Apocynaceae*).—A woody climber of North Kanara. It has white fragrant flowers, and opposite leaves nearly 12 by 10 inches, and oval warts on the bark. It probably has caoutchouc, as the latex had coagulated the last time it was observed, in May.

COLOMBIAN or "CARTHAGENA" RUBBER, from *Sapium biglandulosum*.—The tree grows at altitudes of 5,500 to 8,000 feet on the Andes, and is said to yield a sap giving 10 per cent. of caoutchouc.

COLORADO RUBBER, from a species of *Hymenoxys* (N. O., *Compositae*). It has not yet reached the market.

CRYPTOSTEGIA GRANDIFLORA—in the vernacular, *valayeti vakundi* (a native of Africa)—is a charming woody climber growing about 10 feet high. It bears rosy flowers, succeeded by triangular fruits in pairs without stalks (follicles) about 5 inches long, and from 1 inch on each of the three faces, to a point at the free end. It grows without irrigation in fences, and on the river bank at Poona, where it gets slight shade. Under cultivation it would need good soil (which had been tested by growing ordinary field crops), and slight irrigation occasionally the first year, so that the supporting plants may get their roots down to a depth. Lines of *Sheweri*, *Pangara*, and a few *Nim* should be sown 5 feet apart, and a year later the plants pulled out in every alternate foot, and a few seeds of *valayeti vakundi* sown. To obtain seeds in good order, it is necessary to tie the fruits slightly, because if this is not done, the fruit may burst, and the seed be carried away by the wind, as each seed has a parasol-like appendage which assists its dispersion by a breeze. Let the level of the field be so arranged that no rain may run off, all to be passed through the soil, over as wide a surface as possible, and the surface be kept friable. In my experiments it yielded a fine elastic rubber, and Professor Dunstan, a London expert, says the rubber submitted to him produced by this plant had 64 per cent. of caoutchouc, and 14 per cent. of insoluble matter. Mr. Birdwood took much interest in this plant at Kurachi, and produced a considerable quantity of rubber, but with me its produce was very slight. The cost of collecting was equal to the value of the rubber *then*; it may be very different now.

EUPHORBIA NERIIFOLIA—*Sher, Nurang*.—A small tree of Western Himalaya, often used for fencing in Western India. It is leafless the greater part of the year. Leaves small, linear. It contains rubber, but is only mentioned here to warn investigators. It formerly was used to seal letters. The tree also contains what the husbandman in "Marati" calls a *wauf*, a vapour which it gives out when wounded. There were the remains of an old fence in a piece of ground in my charge, which it was desirable to remove. In cutting it down, the man employed suffered greatly, and I also had to spend three days in hospital as the result of going to see what was the matter.

FUNTUMIA ELASTICA—*Funtum, Ire, Fisunga*.—A African tree growing 100 feet in height, with an erect, cylindrical, whitish, spotted stem; found in Liberia, Gold Coast, Cameroons, Lagos, Old Calabar, and many other of the moist parts of tropical Africa. It is one of the most important sources of West African rubber. The same tree is known as *Kickxia elastica*.

There are several other African species not commended for rubber.

FIJI RUBBER—*Alstonia plumosa*.

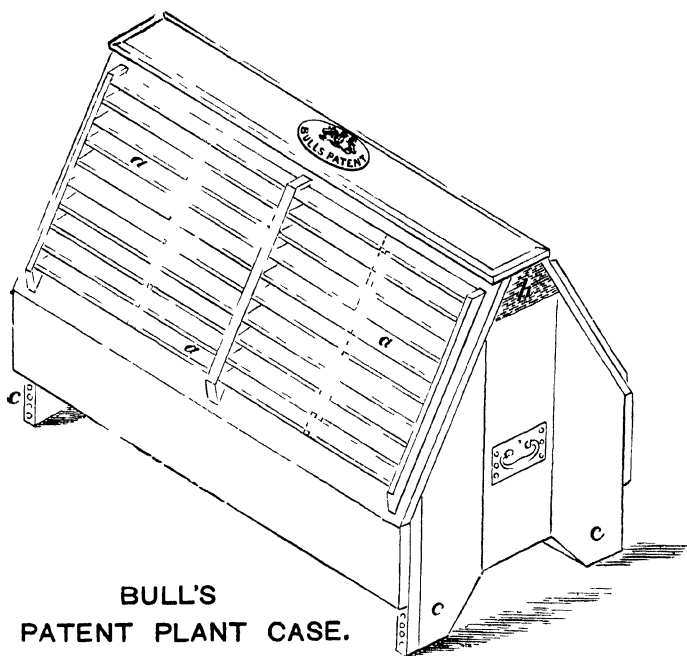
GUIANA RUBBER TREE—*Forsteronia gracilis* (N. O., *Apocynaceae*). A large climbing plant found in the forests of Demerara.

LAGOS RUBBER TREE—*Ficus Vogelii*, the *Abba*.—A large "fig" abundant in Lagos, West Africa. Easily propagated.

MADAGASCAR RUBBER.—All the recognised sources of rubber are cultivated in Madagascar. Best of the indigenous sorts—*Landolphia Perieri*, and *Lowariensis*, woody climbers.

MANGABEIRA RUBBER is the product of *Hancornia speciosa* (N. O., *Apocynaceae*). Fruit edible, yellow, speckled red. Cultivated in the regions which lie to the south of the forests of the Amazon.

PARA RUBBER TREE—*Hevea brasiliensis*, *Cahuchu*, *Heve* or *Jeve* (N. O., *Euphorbiaceae*).—A slender tree, reaching a height of 50 to 60 feet, with a circumference of 6 to 8 feet, and probably other species, yield the form of rubber known as "Para." This tree grows in low-lying lands near rivers, but beyond the reach of floods.



**BULL'S
PATENT PLANT CASE.**

WARDIAN CASE.

A case for carrying living plants on long voyages. It should remain on deck, in a light but shaded place.

It is not particular regarding soil, but it evidently (in Ceylon) does not like sandy soil. It is evidently a surface feeder. The climate of the district which yields the best rubber is very equable but hot, 87° at midday and 74° at night; the greatest heat is 95° and the mean of the year 81°. The rainfall occurs principally from January to June; the greatest rainfall is in April, 15

inches. Seeds from wild trees are difficult to obtain, and the seed soon loses its vitality. It germinated at Mergui in three to four days. The tree is now established at Henaratgoda, and in Edangoda by the Peradeniya Botanic Garden, Ceylon, and Kew has distributed it to all the British colonies or protectorates that have a hot, moist climate. Seeds packed in damp powdered charcoal have been sent by post to other countries with success. Another successful means is to plant the seeds in a wardian case, and allow them to grow on the way. The leaves have three deep divisions, digitate-trifoliate, on long slender petioles, alternate. At Mergui the flowers appear in January and the fruit ripens in July to August.

PERUVIAN RUBBER TREE—*Castilloa elastica*, *Caucho* (N.O., *Urticaceae*).

WEST INDIAN RUBBER TREE—*Forsteronia floribunda* (N. O., *Apocynaceae*), the *Milk-wythe* or *Milk-vine* of Jamaica.—Grows in Manchester and St. Elizabeth parishes of Jamaica. Yields excellent rubber.

BALATA is produced from *Mimusops globosa* (N. O., *Sapotaceae*).

CHINESE GUTTA-PERCHA TREE—*Eucommia ulmoides*, *Tu chung*.—Long considered of medicinal value, *Tu chung* is cultivated in Szechuan, Hupeh, and Shensi, and brought to Hankow. *Eucommia ulmoides* has been grown outside in Kew during six years. It is a vigorous free-rooting plant grown from cuttings, about 6 inches long, taken in July and August, and inserted in sandy soil with slight bottom heat.

All interested in Rubber should read full particulars in Kew Bulletin, Additional Series, VII., *Selected Papers from the Kew Bulletin—III.*, *Rubber*, by post, 1s. 10d., from Messrs. Wyman & Sons, Fetter Lane, London, E.C.

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ERRATA.

Page 65, line 9 from foot—*For Babu read Babul.*

- „ 81, „ 12—*For carbine read carbon.*
- „ 106, „ 25— „ *Hariati* „ *Hariafi.*
- „ 112, „ 18— „ *M'Bhide* „ *Bhide.*
- „ 143, „ 11— „ *Latisimi* „ *Laxismi.*
- „ 185, „ 3— „ *varietiel* „ *varieties.*
- „ 187, „ 1—*After Gossypium read COTTON, KAPUS.*
- „ 209, „ 6—*For LIMUM* „ *LINUM.*
- „ 304, „ 12 —*After GLOBULUS add Blue Gum.*
- „ 305, „ 26—*Before GUAVA read LYTHARIE.*
- „ 308, „ 11 —*For FLORIBUNDI read FLORIBUNDA.*
- „ 350, „ 26— „ *MOSSÆNDA* „ *MUSSÆNDA.*
- „ 363, „ 21—*After Auruntica add may have the same effect.*
- „ 364, „ 3—*For HELICHRYSUN read HELICHRYSUM.*
- „ 373, „ 24— „ *CAINOTO* „ *CAINITO.*
- „ 382, „ 10— „ *shape* „ *shade*
- „ 385, „ 15— „ *aciminata read acuminata.*
- „ 408, „ 17— „ *succmosa* „ *racmosa.*
- „ 434, „ 7— „ *GYMDOSTACHUM read GYMNOSTACHUM.*
- „ 434, „ 14— „ *HEMIGRPHIS read HEMIGRAPHIS.*
- „ 462, „ 2— „ *Bath read Bark.*
- „ 467, „ 8— „ *RACIMUS read RACINUS.*
- „ 481, „ 1-- „ *Cross-section, etc., read Cross and vertical sections, etc.*
- „ 485, „ 30— „ *SYCOMOMORUS read FICUS SYCOMORUS.*
- „ 509, „ 13— „ *ODOTOGLOSSUM* „ *ODONTOGLOSSUM.*
- „ 570, „ 10— „ *CARYOTA read CARYOTA SOBOLIFERA.*
- „ 619—*Add as foot-note, Since going to press, identified as a Mushroom.*

While this book was passing through the press, Mr. Woodrow, unfortunately, had a severe illness.

